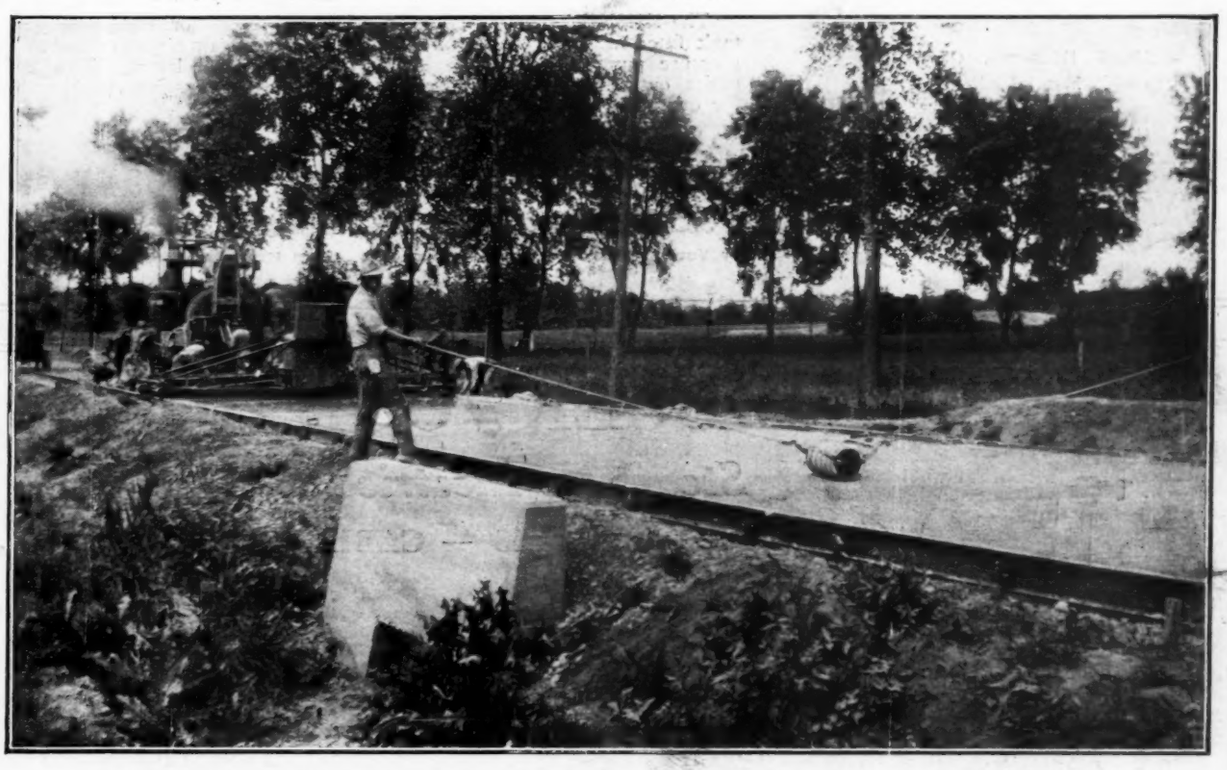
PUBLIC WORKS.

CITY COUNTY STATE

A COMBINATION OF

"MUNICIPAL JOURNAL" and "CONTRACTING"



ROUGHENING CONCRETE BASE FOR ASPHALT SURFACE ON CHICAGO, WAUKEGAN & MILWAUKEE ROAD

This work will be described next week

IN THIS ISSUE

OCTOBER 30, 1920

PUBLIC WORKS.

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Fitchburg Sewage Treatment Plant

This plant is six years old and during that time has been operated under careful, expert supervision and excellently full records kept. It is therefore one of the important ones of the country to the sewerage engineer and chemist-biologist. During all of last year the sprinkling filter was run at about double rate in order to learn how long it would serve without extension. Deposits of grit from combined sewers in the Imhoff tanks are believed to have caused foaming, and were removed, but with difficulty. The tanks averaged 98 per cent removal of settleable solids—higher than previously because of skimming and keeping slopes and slots clean. The general efficiency of the plant was good; the final effluent was always non-putrescible by the methylene blue test. Considerable attention was paid to the appearance of the grounds, trees and shrubs planted, roads surfaced, etc. The total cost of operating the plant was $9.56 per million gallons, or 30.3 cents per capita served, not including the cost of pumping part of the sewage or the overhead charges.

The sewage treatment plant at Fitchburg, Mass., is one of the most interesting in the country, chiefly because of the careful and scientific operation which it receives and the pains which are taken to detect and eliminate any features of the operation which tend to limit the efficiency that it is possible to obtain from it. The plant was described quite fully in Municipal Journal for September 17, 1914, but it seems desirable to briefly restate the principal features of the plant as a preliminary to a report on last year's operation.

In both the preliminary studies and the preparation of the final plans for this plant, David A. Hartwell, who is commissioner of public works and city engineer of Fitchburg, was in charge, with Harrison P. Eddy as consulting engineer.

The plant consists of five rectangular Imhoff tanks, two acres of sprinkling filters, four circular secondary settling tanks, and about four-tenths of an acre of sludge drying beds. The sludge beds lie slightly higher than the sludge compartments of the Imhoff tanks, and sludge from the latter is lifted by compressed air onto the beds. In reaching the plant the sewage passes through a 30-inch siphon about a mile long, between which siphon and the tanks is a 30 x 15-inch venturi meter.

Each tank is 31 feet wide by 90 feet long and contains three hopper bottoms which are 7 feet 6 inches deep; the total depth of the tank being 25 feet 11 inches, or 24-feet 5 inches to the top of the sewage in the sedimentation compartments. The sludge compartments were calculated for a capacity of six months' sludge accumulation.

The filters are 223 feet by 405 feet and the broken stone is 10 feet deep to the bottom drainage system.

The secondary tanks are 30 feet inside diameter with vertical side walls 14 feet 9 inches high and conical bottoms having a depth of 9 feet 3 inches; giving a depth of liquid in the tanks of 22 feet 9 inches. The filter effluent enters each tank through a vertical pipe in its center with the outlet near the bottom and leaves the tank through weirs around its circumference. The tanks are designed for a retention period of one hour. The deposits in the secondary tanks are pumped back into the Imhoff tanks to be digested with the crude sludge settling in such tanks.

The cost of the plant was about $309,000, including $25,000 for the land. Four per cent interest and six per cent sinking fund on this cost would give an annual charge of about $31,000. The plant was first put in operation in October, 1914, but all the parts of the plant were not in full working condition until June, 1915.

The report of Commissioner Hartwell, accompanied by that of Herbert B. Allen, chemist in charge of the disposal plant, for the year 1919 is

of interest and value to sewerage engineers and officials, a special feature of interest being the cleaning out of the Imhoff tanks, the reason for it and the information obtained thereby.

IMHOFF TANKS

"Investigations while pumping sludge from the Imhoff tanks seemed to indicate that there was considerable matter in these tanks that was not being moved or lifted by the air-lift. As none of the five tanks had been emptied since put in service in October, 1914, it seemed best to empty one or two of the tanks in order to study their condition." Tanks 1 and 2 were cut out of service during the winter of 1917-1918, and on examination to discover why water broke through to the sludge pipe inlet before any considerable part of the sludge had been removed from the hopper, it was found that the hoppers were nearly full of inert solid matter. It had been known for some time that grit was being deposited in tank number 5, as evidenced by the material found on the slopes of the sedimentation compartments and the difficulty encountered in starting the flow of sludge in the end hoppers when beginning to pump. It was accordingly decided to clean this tank first and it was cut out of service on April 2 and allowed to stand with a view to securing complete digestion of the sludge before cleaning it.

It was decided to pump sludge from time to time as it became digested, but no sludge could be lifted from the end hoppers, although it was possible to do so from the middle one. Upon applying a jet of water from a 1-inch hose that was lowered through the sludge pipe while the compressed air was on, some sand and pebbles as large as small plums came out, together with water from the hose, but no sludge. The tank was then pumped down to the sludge, but it was found impracticable to pump the sludge with either a diaphragm pump or a pulsometer. An attempt was made to pump the sludge with a 6-inch Koerting water jet eductor, with Siamese connection to two lines of fire hose attached to hydrants, but the opening was found to be too small. Then a Hancock ejector with an opening of about 1½ inches between the end of the nozzle and the outer edge of the discharge tube and a 2.3-inch throat was purchased and worked very satisfactorily when the solids were flushed into it through a screen of ¼-inch mesh.

After pumping out all the liquid sludge which would flow to the ejector, solid matter remained in hopper number 1 which was calculated to have a volume of 145.1 cubic yards. The matter found in hopper number 2 was calculated at 92.7 cubic yards, and that in hopper number 3 at 129.1 cubic yards; making a total volume of solid matter in the three hoppers of 366.9 cubic yards. The cost of labor involved in removing this material by means of the ejector was $232.90, equivalent to 63.5 cents per cubic yard removed. The end hoppers contained large proportions of grit, including pebbles and cinders of considerable size. The middle hopper contained comparatively little grit, but the material was quite solid and dense.

Tank number 5 was put into operation again on September 17, being seeded with 1,675 gallons of sludge from tank number 4, and good gas action was apparent on September 20. Scum began to form immediately, although it consisted at first very largely of undigested material.

On August 30, tank number 2 was cut out of service, the liquid matter removed and afterward the solid matter as in tank number 5. In this tank 191.6 cubic yards of solid material were found in the first hopper, 175 in the second hopper and 158.3 in the third hopper; making a total of 524.9 cubic yards in the tank. The cost of labor for cleaning this tank was $231.48, or 44.1 cents per cubic yard of solid matter removed. The solid matter in this tank was practically free from grit, but was sticky and pasty in consistency, which condition was believed to be largely due to the presence in the sewage of wash water from the coating room of a paper company, which contains lime, casein and glue. There was also nearly a cubic yard of material removed by buckets, most of which was concrete which had fallen into the tank when repairing chimneys in 1915. This tank was put into operation again on October 23.

From the information obtained by these cleanings, Mr. Hartwell concludes that it would be desirable to clean one or two of the Imhoff tanks each year.

The presence of so much grit in these tanks is undoubtedly due to the fact that a considerable part of the sewerage system of Fitchburg is on the combined system. All new sewers connected with the treatment plant are laid on the separate system, and some of the old ones have been changed over to this system and it is the aim to carry on this change to the separate system as rapidly as finances and circumstances permit. For the present, however, it is necessary to operate the system with this handicap of the introduction of storm sewage and its accompanying grit and other street washings.

The Imhoff tanks were in continuous operation through the year except upon five separate occasions totaling 3.33 days, at which times a blow-off from the siphon to the river was wide open for the purpose of drawing down the Imhoff tanks to receive secondary tank sludge or for cleaning and repairs. This blow-off is also opened partially during times of excessively high storm flow to protect the tanks from an undesirably large amount of storm water, this having been done fifty-three times during 1919, generally for only a few hours.

The total quantity of sewage treated by the tanks was 1,219,901,000 gallons, or an average of 3,351,380 gallons a day. The computed periods of detention of sewage in the tanks ranged from 4 hours and 5 minutes in May, to 9 hours and 30 minutes in October, with a minimum rate for only 24 hours of 3 hours and 48 minutes on March 26 and a maximum of 20 hours on October 12. The flow through the tanks was reversed at the beginning of each monthly period, with the exception of the beginning of April.

The average monthly removal of settleable solids as shown by the Imhoff glasses varied from 96.02 per cent in July to 99.99 per cent in November, averaging 98.04 per cent for the entire year. The removal of total suspended matter has varied from 47.6 per cent in April to 84 per cent in September, averaging 66.5 per cent for the year. The amount of total dry solids removed was 823.7 tons. In addition to this, 62.1 tons of dry solids were added in the form of sludge pumped from the secondary tanks, making a total of 885.8 tons of dry solids deposited as sludge in the Imhoff tanks.

The percentage of settleable solids removed was higher and more uniform than in previous years on account of more careful skimming of the tanks and keeping the slots and the slopes leading to the slots in a cleaner condition. The systematic flushing of the surface of the tanks during warm weather also tended to increase the percentage of settleable solids removed and at the same time maintained a more satisfactory appearance of the tanks.

The grease and other material floating on the surface of the tanks was removed about three times a week on the average, the total quantities so removed amounting to 18.8 cubic yards, or an average of 1.4 cubic feet per day.

The level of sludge in the Imhoff tanks was determined frequently by the use of the Pitcher pump with graduated suction hose and whenever the sludge was found to be too near the slots it was lowered by pumping.

The gas vent chimneys of the Imhoff tanks have been gradually disintegrating above water level and last year the tops of six of them were rebuilt with 4-inch brick walls washed with cement grout.

At two or three different times during the summer when sludge digestion was most active, excessive foaming was experienced in the chimneys of tanks 1 and 2, making it necessary to apply the hose to prevent them from overflowing. This foaming was attributed to the large volume of secondary tank sludge that had been pumped into these tanks, but it seems probable that the underlying cause was the restricted capacity of the sludge compartments resulting from the accumulation of solid inorganic matter in the hoppers which could not be removed by the air-lift. Early in the spring, when pumping of the Imhoff tank sludge was resumed, it was found that the sludge in these two tanks was not well digested, which probably was due both to the accumulation of solid matter referred to and also to the large volume of secondary tank sludge which was pumped into these tanks. The warm weather which followed soon after so facilitated sludge digestion that it was necessary only to pump out a comparatively small volume of undigested sludge.

The dosing tanks were cleaned twice during the year, in May and October, a total of 7.8 cubic yards of sludge being removed from the bottoms of the tanks. The apparatus worked well except once or twice when it was necessary to flush out the air pipes, which had become clogged with growths.

SPRINKLING FILTERS

The trickling filter, or sprinkling filter, received the entire Imhoff tank effluent, except on four occasions totaling 24 hours while tank number 5 was being pumped down. The rate of treatment averaged 2,690,000 gallons per acre per day. On November 30, 1918, seven distributing lines on one side of the filter were shut off, flushed and drained, and this portion of the filter was allowed to stand idle during the entire year in order to determine whether the filter could operate at a rate sufficient to accommodate the increase in population for several years to come. This reduced the working area from 2.108 acres to 1.24 acres, and the computed increase in load was approximately 70 per cent. In spite of this, there was no material increase in pooling of sewage on the surface of the filter or in accumulation of organic growth, and nothing was done to the surface of the filter except loosening the top stones during the winter on a few small areas where slight pooling was in evidence.

Spiders were very thick about the filter in the early spring, but during the remainder of the season neither spiders nor flies were troublesome.

The total number of full-size nozzles in use during the year was 265. These were kept clean even more thoroughly than before, the number of cleanings averaging 22.2 per day. The increased frequency was due both to more careful attention and to the increased volume of sewage applied per nozzle. The distributing lines were drained and flushed three times during the year, which operation greatly reduced the nozzle clogging and it is proposed to make this a regular practice in the future.

The unloading of the solid matter stored in the filter during the winter months began about April 10, earlier than usual on account probably of the open winter and early spring. The rate of unloading, as computed from the suspended solids in the trickling filter effluent, shows that the maximum unloading occurred during the week ending May 29, when the effluent contained a total of 18,800 pounds of suspended solids, equivalent to 215 per cent of the average. The minimum quantity of suspended solids discharged occurred during the two weeks ending December 12th, when it was 40 per cent of the average.

Owing presumably to the increased load on the filter, its efficiency was slightly less than for the preceding year. The average flow treated was 20 per cent greater than for the preceding year and the area was reduced 41 per cent. This resulted in an increase in load which, measured by the different constituents, ranged from 98 per cent to 184 per cent. In spite of this, the effluent has been very satisfactory and all daily samples of the final effluent has been found stable by the methylene blue test, for the full period of fourteen days.

SECONDARY TANKS

In April, a T and valve were inserted in the sludge pipe in each of the secondary tanks, permitting the removal of the liquid matter down to the top of the conical bottom before beginning

pumping of the sludge. This did away with the pumping of 30,000 gallons of top water when cleaning the tank, and the sludge without the admixture of this top water settles more readily when pumped to the Imhoff tanks. This materially reduces the cost of operation of cleaning the tanks. In cleaning the tanks, sludge is pumped from the bottom of the cone until water appears at the pump; then, using the new T, the water is drawn down to the top of the conical bottom; finally, the remainder of the sludge and water, together with that used in washing down the tank, is pumped to the Imhoff tank. The secondary tank is then put into operation again.

During the mild winter of 1918-1919 very little trouble was experienced with the formation of ice on the surface of the tanks.

The total quantity of sludge removed from the four secondary tanks during the year was 360,078 gallons, containing 93.28 tons of dry solids, of which 62.07 tons of dry solids was pumped to the Imhoff tanks for digestion. The specific gravity of the sludge varied from 1.007 to 1.035, averaging 1.020. The percentage of solids in the sludge varied from 4.07 to 7, averaging 6.11. The percentage of organic matter in the total solids ranged from 45.26 to 48.19, averaging 47.12.

SLUDGE BEDS

During the year the eleven sludge drying beds received 499,585 gallons of sludge, containing 234.77 tons of dry solids. They were cleaned from three to five times each and there was removed from them 944.06 cubic yards of dried sludge. In addition, 913,140 gallons of sludge containing 406.01 tons of dry solids were pumped to a low area known as bed number 12.

The sludge pumped during the early part of the summer had a slight undigested odor which is explained by the condition of the tanks as described above. The sludge as removed from the drying beds has varied in percentage of total solids from 26.40 to 93.30, averaging 54.25; and the organic matter ranged from 36.21 to 54.62, averaging 44.98. The weight of dry sludge has varied from 1,006 pounds to 1,735 pounds per cubic yard, averaging 1,422. Mr. Allen states that it will be necessary to increase the sludge bed area at least 50 per cent in order to handle all of the sludge from the Imhoff tanks, including that from the secondary tanks.

EFFICIENCY OF THE TREATMENT

The report gives weighted average monthly analyses of sewage and effluents for the year, and averages for the entire year. Analyses were made from sterilized weekly composites of daily samples taken hourly between 7 a. m. and 6 a. m., sulphuric acid and formaldehyde being used as sterilizing agents.

Free ammonia was increased 5.02 per cent from crude sewage to Imhoff tank effluent, and was decreased 57.4 per cent from Imhoff tank effluent to sprinkling filter effluent, with no further decrease in the final effluent. The dissolved albuminoid ammonia was increased 1.6 per cent between crude sewage and Imhoff tank effluent and was decreased 47.9 per cent between Imhoff tank effluent and sprinkling filter effluent, and a further 4 per cent between the latter and the final effluent. Suspended albuminoid ammonia was decreased 54.8 per cent between crude sewage and Imhoff tank effluent, a further 38.1 per cent between Imhoff tank effluent and sprinkling filter effluent, and a further 29.5 per cent between the latter and the final effluent, Nitrites in the crude sewage averaged .076 parts per million, .167 in the Imhoff tank effluent, .23 in the sprinkling filter effluent and .248 in the final effluent. Nitrates increased from .728 in the crude sewage to 7.119 in the sprinkling filter effluent and 7.270 in the final effluent. Chlorine averaged 62.1 in the crude sewage, and 62.2 in each of the several effluents. Oxygen consumed (total, digested thirty minutes in boiling water) averaged 143 in the crude sewage, 89.7 in the Imhoff tank effluent, 58.4 in the sprinkling filter effluent and 52.6 in the final effluent. The total residue on evaporation averaged 576 parts in the crude sewage, 413 in the Imhoff tank effluent, 351 in the sprinkling filter effluent and 334 in the final efflenut; 304 parts of the last being dissolved and 30 parts suspended.

Taking the complete plant, from crude sewage to final effluent, the free ammonia was reduced 55.3 per cent, dissolved albuminoid ammonia 49.2 per cent, suspended albuminoid ammonia 80.3 per cent, oxygen consumed 63.2 per cent, residue on evaporation, total 42 per cent, dissolved 9 per cent, suspended 87.6 per cent.

GRIT CHAMBERS AND SCREENS

There are two grit chambers along the line of the intercepting sewer used to intercept sand and grit and prevent its reaching the inverted siphon and the treatment plant. These chambers were cleaned five times during the year and there was removed from them 243.87 cubic yards of material. In addition, there was removed 37.1 cubic yards of grit at the grit chamber in the pumping station. At the upper end of the siphon is a siphon chamber and in this a screen intercepted 28 cubic yards of screenings during the year, while a screen in the pumping station removed 7.8 cubic yards. The cost of removing and disposing of the screenings from the grit chambers averaged $3.89 per cubic yard. The material removed apparently contained a smaller percentage of organic matter than in previous years, being less offensive in odor. The material removed was dumped upon low land.

The siphon chamber screen is in the form of a rack with openings 1⅝ inches wide. It is raked twice a day and the screenings disposed of by burying in the ground. The total cost of caring for the screen and disposing of the screenings averaged $6.52 per cubic yard of screenings removed.

PUMPING PLANT

The sewage from the South Fitchburg district has to be pumped to the siphon line, and two centrifugal pumps are used for this purpose. Prior to June 1 the cost of operating and maintaining a pumping station was charged against the treatment plant, but after that it was charged to the

sewer maintenance account. During the six months ending May 31, the total cost of operating the pumps was $2,238.34, of which power and repair to pumps cost $1,271.33, supervision and raking of screen, $40.86; removal of grit, $240.57; and overhead, $685.58. With the construction of storm water drains in this district the cost of power for pumping was greatly reduced. The grit chamber was constructed in August, along with some other improvements, and since then the pumps have been more efficient, and it is expected that the efficiency and economy of operation will be further increased by the proposed elimination from the sewage of large quantities of wash water from the paper plant containing lime, casein and glue. These pumps work most efficiently at the normal flow of four to six million gallons a day, the efficiency decreasing if the flow falls below or rises above this rate.

CARE OF GROUNDS

Considerable attention has been paid to improving the appearance of the grounds in which the plant is located. During the months of April and May, 1919, the Park Department trimmed all of the shrubs about the grounds, spraying with lime and sulphur those which showed signs of blight, set out rock maples to take the place of those that had died, and put in a few Norway spruces on the drive leading to the Imhoff tanks. Most of the shrubs and trees set out in previous years are still living. During the year the roads were all cleaned once and the weeds removed around the shrubs. The roads leading to and about the plant were coated with Tarvia and sand in the fall of 1919 and needed no further attention. During the year the fences bordering the main roadway were painted.

COST OF OPERATION

The total cost of operating the sewage treatment plant (exclusive of the pumping station by which low-level sewage is lifted to the plant) was $11,596.07, equivalent to $9.56 per million gallons of sewage treated, or to 30.3 cents per capita served. This is materially greater than in 1918, partly because of the increased cost of labor and material but principally owing to the cost of the cleaning of the Imhoff tanks and repairs and improvements made. (This does not include the $31,000 interest and sinking fund expenses for the plant as estimated in the opening paragraphs of this article.) This total cost is divided as follows:

Grit chambers, $1,340.80. Siphon chambers, $263.82. Imhoff tanks, $5,222.20. Sludge beds, $1,026.60. Trickling filter, $1,899.04. Secondary tanks, $1,843.61.

The cost of operating the several subdivisions of the plant is divided in the accounts as follows: Imhoff tanks—cleaning and repairs, $838.70; repairing and power for pumping, $1,026.22; watching and sampling, $1,757.60; and overhead, $1,599.68. Trickling filter—repair, $443.49; watching and sampling, $873.80; overhead, $581.75. Secondary tanks—repair and power for pumps, $101.75; watching and sampling, $873.80; improvements, $303.36; overhead, $564.70. Sludge disposal—cleaning beds, $712.35; other charges, $314.25.

Classifying the maintenance accounts in another way, the expenses are given as follows: Administration, $760.75; laboratory, $988.43; grit and siphon chambers, $1,112.75; Imhoff tanks, $3,622.52; trickling filters, $1,317.29; secondary tanks, $1,278.91; sludge beds, $712.35; care of grounds, $920.76; pumping station, $1,552.76; supplies, $134.67 miscellaneous repairs and expenses, $1,433.22.

The Miles-Acid Process on Tannery Waste

By E. S. Dorr*

The author, in a paper before the American Society for Municipal Improvements, tells of an apparently successful test, with by-products valued at $300 per million gallons of waste water.

In June, 1916, a sample of tannery waste was submitted to the Miles-acid process. The sample was very high-colored and was heavily charged with organic and mineral matter, 6,449 ppm, of which 4,866 were mineral and 1,583 organic and volatile. Upon the application of sulphur dioxide the waste cleared in about five minutes and was well settled in half an hour. The dark blackish-red color was bleached to straw color, the SO_2 used was at the rate of 860 ppm (7,167 lbs. per mg). Probably 900 ppm (7,500 lbs. per mg) would be advisable to secure sterility Bacterial reduction was not noted.

The odor was completely killed.

The reduction in the organic and volatile matter, including suspended solids, was 50 per cent.

The precipitated sludge was at the rate of about 4 tons (dry) per million gallons with a grease content of 16.88 per cent and ammonia content of 7.50 per cent in the undegreased and 9 per cent in the degreased sludge. In pounds the amounts are 6,640 lbs. degreased sludge, or fertilizer material, and 1,360 lbs. grease.

The fertilizer with 9 per cent ammonia at $7.50 per unit (value of tannery tankage in August, 1920) would be worth $67.50 per ton, or 3.3 tons would be $222.75 per million gallons.

The grease at the prices assumed in the New Haven investigation (and tannery grease is probably worth more) would be worth, at 5 cents per pound, $68 and at 8 cents per pound $108.80 per million gallons. So that the total value of grease and fertilizer would run from $290.75 to $331.55 per million gallons treated, according to the quality of the grease. (The free fatty acids were 48 per cent, percentage of unsaponifiable was not determined.)

On the other hand, the cost of operation would be high. About five times as much acid would be

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required, and twenty times as much sludge per million gallons would have to be handled, as at the Boulevard sewer in New Haven. The cost of operation at that outlet was reckoned at $20.98 per million gallons, of which $10.74 was for acidification, as the flow was not large, about 6,000,000 gallons per day. The New Haven figures may be taken as a basis for estimating the probable cost of handling tannery waste. Correcting, in the ratios indicated above, for the heavier tannery waste, the cost per million gallons would be $161.22.

The values of the products have been figured above at from $291 to $331 per million gallons treated. The estimate therefore shows a surplus of values over costs of $130 to $170 per million gallons.

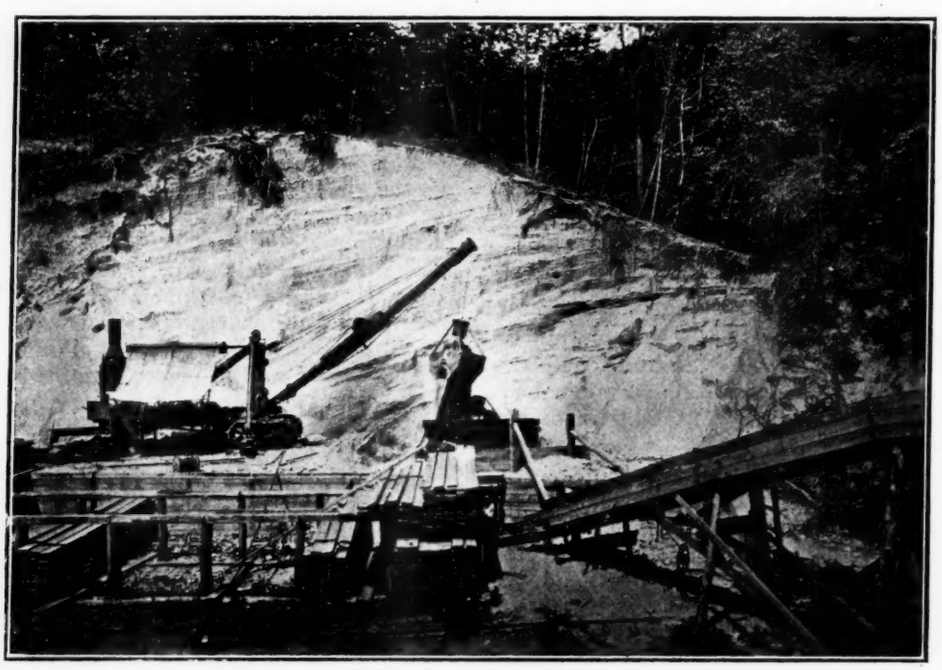
In view of the fact that, so far as the writer is aware, no revenue has been obtained from tannery wastes, but, on the contrary, they are a source of expense for disposal, it would seem that this process is worthy of the attention of tanners. In addition, the facts that the sludge and effluent are inodorous, that the color is so bleached that with reasonable dilution it would not be noticeable except close to the outlet, and that the effluent is sterile or can be made so by the addition of acid (for the cost of which there is ample margin between values and costs) should still further commend it to attention and experiment.

Huntington-Cold Spring Harbor Road Construction

Six miles of 20-foot concrete pavement built at an average rate of 350 linear feet per day with small labor force and special equipment. Materials stored by mechanical plant and delivered by gravity to motor trucks carrying multiple batches 1 to 6 miles to load concrete mixer direct.

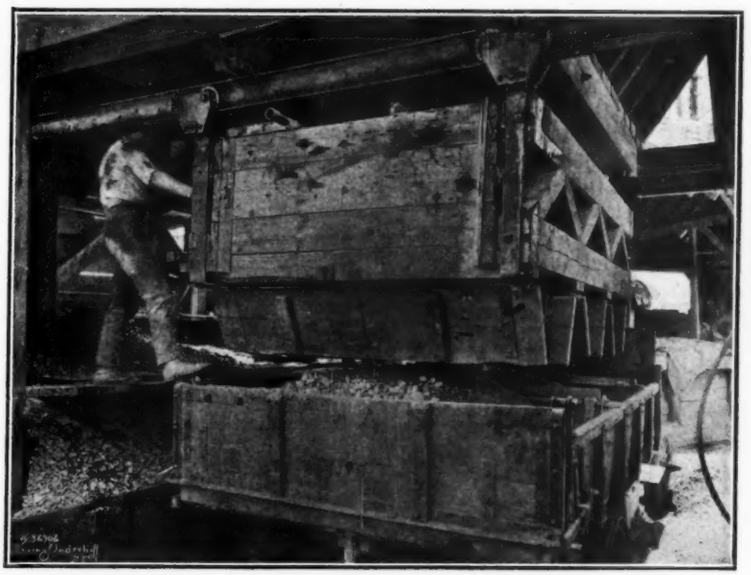
The New York State road from Huntington to Cold Spring Harbor, Long Island, has a standard concrete pavement 20 feet wide and 6 miles long, built under the direction of the State Engineer of Highways by the R. W. S. Corporation, contractor. The work has been executed with unusual economy and rapidity, largely due to the good judgment and liberal policy of the contractor, who made a thorough preliminary study with special reference to the use of improved equipment for expediting the work and reducing its cost. Suitable and up-to-date plant was selected and installed, methods were determined, and operations were scheduled in advance of the beginning of the work, which has been carried out very satisfactorily in accordance with the program.

The principal features have been the mainte-



LOCOMOTIVE CRANE WITH CATERPILLAR TRACTION EXCAVATING SAND FROM PIT AND DELIVERING TO HOPPER OF BELT CONVEYOR FILLING ELEVATED BIN.

nance of abundant supplies of aggregate and cement, economical handling in storing and reclaiming it, rapid and accurate measurement and delivery of material as used, and transportation of multiple batches by motor trucks from the central storage plant to a large mixer so as to enable it to maintain unusual continuity of operation.



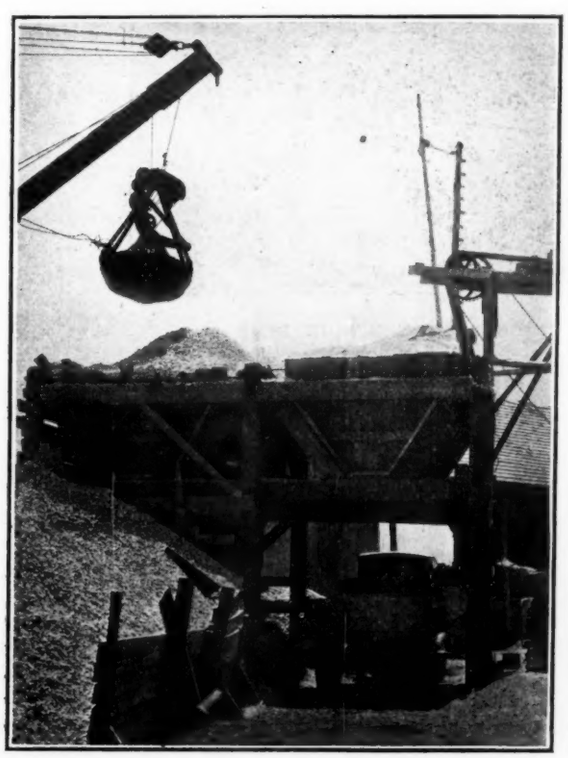
LOADING 3-BATCH MOTOR TRUCK FROM MEASURING BOX UNDER STONE AND SAND BINS.

STORAGE

Broken stone from Tompkins Cove was delivered by barges to a dock at Huntington, where it was unloaded by a 50-foot stiff-leg derrick boom and 1-yard clam-shell bucket that delivered it to an elevated storage bin of 20 yards capacity, which was kept full to supply the constant demand of the concrete mixer. The capacity of the bin being much less than the amount maintained on hand, the surplus, as unloaded from the barges was piled on the ground opposite the bin and reclaimed from the piles and loaded into the bin by the derrick, which performed this service in otherwise idle time, thus practically eliminating the cost of rehandling, and making the entire quantity stored available through the small storage bins.

A sand bank, fortunately located adjacent to the dock, was excavated by a ½-yard clam-shell bucket operated by a Byers locomotive crane with a 50-foot boom that excavated the bank with a face about 50 feet high. As the capacity of the crane was considerably greater than required for the daily consumption, it was only operated about 1-3 of the time, requiring the continual services of one fireman and half of the time of the operator, who also ran the unloading derrick.

The sand was delivered by the clam-shell bucket to a 24-inch belt conveyor 150 feet long driven by an 8-h. p. gasoline engine that elevated the sand about 25 feet and delivered it into a 20-yard elevated storage bin adjacent to the stone bin.



DERRICK AND BELT CONVEYOR DELIVERING BROKEN STONE AND SAND TO LOADING BINS.

MEASURING AND LOADING

Each of the two hopper-bottom storage bins was provided with three horizontal bottom sliding gates placed to correspond with three compartments in a movable measuring box mounted on an overhead track below the bottoms of the bins.

This box was first spotted under the stone bin and received simultaneously three 18-cubic-foot batches of stone. The box was then pushed by hand about 10 feet to position under the sand bin, which similarly discharged into it three 9-foot batches of sand, all loaded by two men in 20 seconds.

An automobile truck with the body divided into three compartments, corresponding with those of the measuring box, was then spotted directly under the measuring box and the double flap bottoms of the compartments in the latter were simultaneously opened, delivering the sand and stone to the batch compartments in the truck. The truck was then taken to the adjacent cement storage house where, from a platform level with its top, 6 bags of cement were emptied by hand into each compartment. In this way each truck was loaded with materials for three 33-foot batches of 1:1½:3 concrete

A fleet of 8 Brockway 3-ton trucks with automatic dumping bodies hauled all of the materials

to the mixer, from 1 to 6 miles distant, at an average rate of about 150 yards hauled 5 miles in 8 hours. The cement was loaded into the trucks by 4 men in 40 seconds and the average time consumed in loading a truck with stone, sand and cement was only 1½ minutes. At the loading plant two laborers were employed in the sand bin, two to operate the measuring box underneath the storage bin, and four handling the cement, besides the two derrick firemen and the machine operator already mentioned. When a barge of cement was unloaded an additional force of six or seven men and a small gasoline hoist were required.

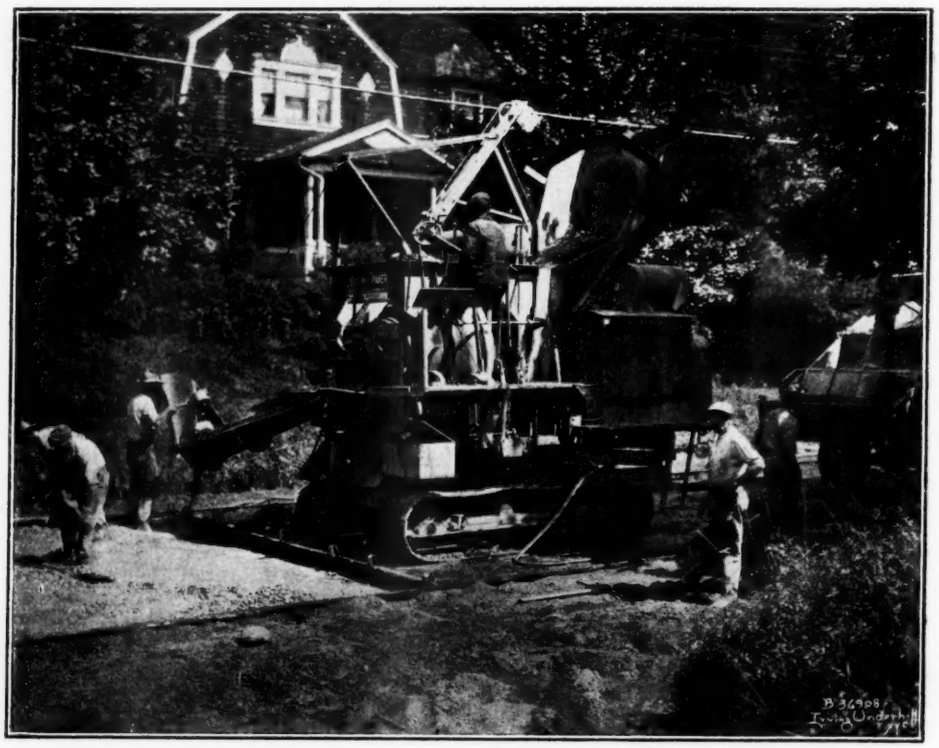
MIXING

Concrete was mixed in a 12-ton Foote machine mounted on a multifoot traction having two 10-foot 6-inch x 14-inch treads which reduced the load on the surface of the ground to about 1,000 pounds per square foot and enabled the machine to advance under its own power without tracks or platforms and to run over grades and rough or soft ground. Usually the machine advanced about 15 feet at a move, which was made in 1 minute. The machine was driven by a 45-h. p. Twin City 4-cylinder tractor engine. It required only a single man to operate it. The ordinary time for mixing was about 1 minute per batch of 23 cubic feet, which was spouted through a 15-foot chute to position on the grade and spread and finished by hand. The machine was advanced about every 4 or 5 batches and made a record of 225 cubic yards in one 8-hour day.

The mixing machine was protected by a bumper log placed on the ground against which the trucks backed up and deposited their contents in the elevating charging hopper of the machine. The three batches were discharged from the truck in about 5 minutes and the truck withdrew, leaving one batch in the drum and one in the hopper.

Each truck body was divided into three batch compartments by two vertical transverse partitions and a tail board, each swinging on pivots at the upper edge, and controlled by an outside latch and lever that held it in position until it was released, when the weight of the materials opened the gate, which automatically returned to closed position when the truck body was lowered. Usually the trucks dumped very freely without help, and only require to be scraped occasionally in very wet weather.

The concrete was finished with a hand roller and with a belt. As soon as the concrete was one day old it was covered with 3 inches of earth and kept moist for one week by use of a hose. Water for the mixer was pumped from a lake by a Domestic gasoline pumping unit with a capacity of 60 gallons per minute, which delivered through a maximum of 10,000 feet of 2-inch pipe, and for the latter part of the job, where no water was available from city supply, worked constantly to fill the demand.



ELEVATING HOPPER CHARGING SECOND BATCH FROM TRUCK IN REAR

At the mixer two men were employed dumping trucks, five men behind the mixer placing and finishing concrete, three men on forms, two men on sub-grade, one man operating the pump and two men covering and wetting the finished concrete.

The average production per 8-hour day was about 350 linear feet or a little more than 150 cubic yards. The best day's run was 494 linear

feet or about 225 cubic yards in 8 hours. On many days 400 to 500 linear feet of pavement were made.

PREPARATION OF SUB-GRADE

The new road replaces an old macadam road 18 feet wide, the surface of which was first broken up with a scarifier hauled by the 10-ton Buffalo-Pitts steam roller used for compacting the ground to sub-grade. After scarifying, the ground was loosened by a road plow hauled sometimes by teams and sometimes by a road roller, and was excavated to a maximum depth of 6 inches by six Meaney wheel scrapers hauled by teams or hauled sometimes by the road roller. The total excavation amounted to about 4,000 yards, most of which was used in building the shoulders of the new road. The concrete was placed in 8-inch Blaw steel forms, about 2,000 linear feet of which were used.

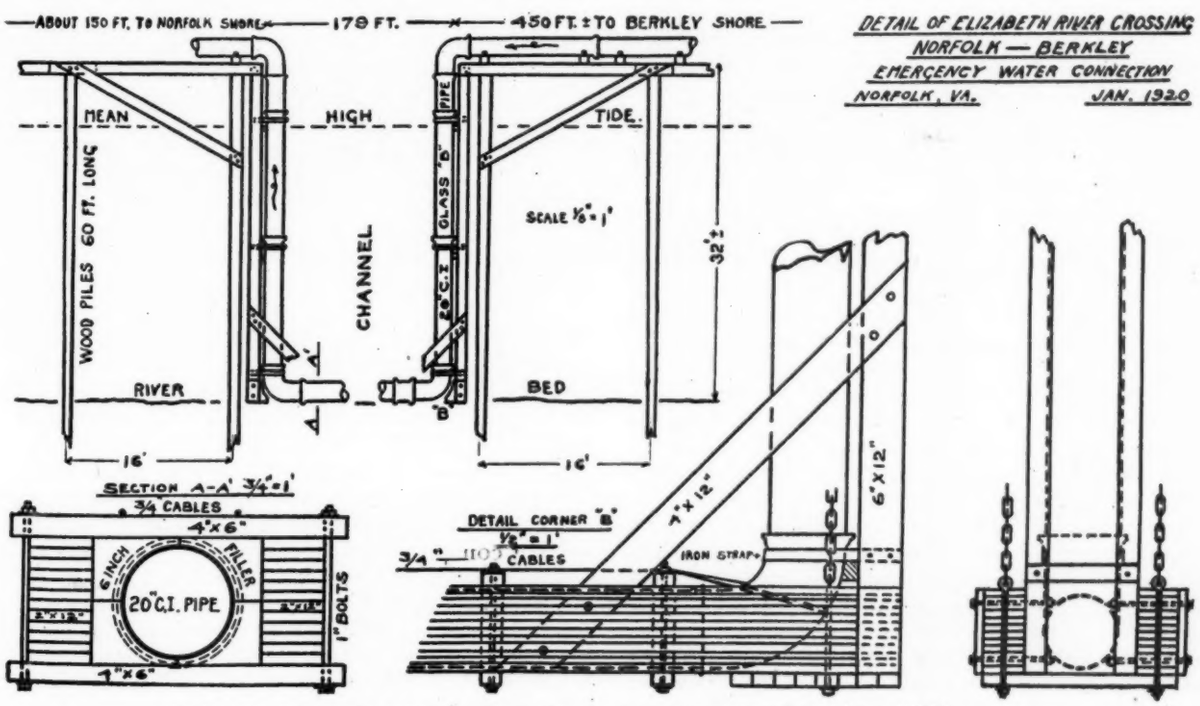
The work was commenced in April and finished about the first of August, the road being opened for traffic in the middle of August. A total force of 21 men, including truck drivers, was required and the work was rapidly prosecuted notwithstanding a delay of 15 days due to several truck drivers' strikes and 10 days or more due to rainy weather when no work was attempted, thus causing a loss of about 1 month in the elapsed time. Assistant Engineer Schultz, in charge for the State, considered it the most rapidly executed work on record.

Norfolk Emergency Water Connection

This Virginia city contracted on a cost-plus basis for laying several miles of 16 and 20-inch pipe to connect with the Portsmouth-Berkley mains across the Elizabeth river. This included a submerged section under the channel of the river, the method of laying which is described herein.

Norfolk, Va., is dependent for its water supply on surface water which is stored in a number of shallow lakes or reservoirs. During the war the pre-war population of Norfolk of about 50,000 was more than doubled and its water supply became insufficient. Across the Elizabeth river was Portsmouth, and this city had a considerably larger supply of water. All of the cities in this section were considerably affected by the activities of the War Department, and that department worked on a plan whereby all the separate water supply systems of Newport News, Hampton, Old Point Comfort, Suffolk, Portsmouth, Berkley and Norfolk were to be connected and consolidated, dams of existing reservoirs raised and new lakes tied in, and when the armistice was signed the government had spent about $2,500,000 on this work, mostly on the Portsmouth side.

With the ending of the war the government dropped this work and put it up to the city to



DETAILS OF SUBMERGED PORTION OF ELIZABETH RIVER CROSSING.

solve its water problem, which remained, as the population of the city is still about double that before the war. It seemed impossible, however, to solve the problem in the way the government was planning because the different cities could not get together, each wanting its own independent water system or else a combination on terms not acceptable to the others. The following year a prolonged dry spell nearly dried up Norfolk's sources of supply, and drinking water was hauled into the town in new tank cars borrowed from the Standard Oil Company. Up to the middle of January of this year nothing had been done except to pray for rain.

As the situation had grown acute, City Engineer Ashburner secured a six months' permit from the Water Department to run a pipe line from the Portsmouth-Berkley supply main, crossing the Elizabeth river on a pile trestle, submerging the channel section only, and connecting it with the Norfolk distribution system. For constructing this line, he purchased from the War Department about 25,000 feet of cast-iron class B bell-and-spigot pipe which the department had purchased in connection with camp construction work in that locality. He also secured from the city council an appropriation of $200,000 for immediate use in securing temporary relief and an ordinance calling for an election on a $6,000,000 bond issue to establish a larger permanent supply for the city. R. B. Porter, who had just completed a large contract for the government at the army supply base, was awarded a contract on a percentage basis to rush a 16-inch and 20-inch cast-iron pipe connection between the Norfolk distribution system and the supply main from Portsmouth to Berkley. Alfred Lewald had been superintendent of sewer and water construction for Mr. Porter in his government contract, and he described the construction of this temporary connection in a paper before the Engineers' Club of St. Louis, of which he is a member. The following description is quoted from this paper.

"To connect the Portsmouth and Norfolk systems, we built a booster pumping station having two direct connected electrically driven 8-inch centrifugal pumps (which the city already had had in use elsewhere) and connected them to the Portsmouth-Berkley supply main with only a three-hour interruption of service on the same. We also laid about 4,850 lineal feet of 16-inch class B bell-and-spigot cast-iron pipe from the booster station through the town of Berkley to the Elizabeth river. The average depth of this was about 4 feet, except where we crossed salt marshes and ran the pipe on cribbing and mud sills. A 20-inch cast-iron pipe was then continued across the river on a wood pile trestle we had previously built of 60-foot piles, two-pile bents spaced about 16 feet apart. This trestle was built parallel to and on the down stream side of the Norfolk-Berkley draw bridge. Opposite to the draw span of this bridge our pile trestle was discontinued and the 20-inch water pipe dropped (as I will later explain) in the form of a U to the river bed about 30 feet below. In this way the pipe line crossed the ship channel and rose again to a pile trestle which led to the Norfolk shore. After reaching the Norfolk side, due to a great many miscellaneous obstructions, such as the Norfolk & Western Railroad yards, which we had to cross, sewers, submarine power, telegraph and telephone cables and gas mains, we had to carry our cast-iron main to a greater depth, which took us below high tide and gave us the obvious additional trouble of fighting the tide water which poured through the oyster-shell-filled ground into our ditch. The connection to the Norfolk mains was then made with a minimum interruption of service. The length of the 20-inch line was about 1,650 lineal feet, making a total of about 6,500 lineal feet of line.

SINKING CHANNEL SPAN

"I will now describe the building, launching and sinking of the U section of the line for the channel span which, with the speed of construction, were the unique features of this work.

"The bottom of the U section, including the two elbows turned upward on each end, was joined, leaded and caulked on shore. This section was 176 feet long.

"The pipe was surrounded by a timber crib, made up of two continuous beams, one on either side of the pipe, whose cross-section was 12 x 24 feet. These beams were built up of 2 x 12-inch boards laid flat, breaking joints and well spiked together. These were built about 180 feet long. Across these and the enclosed pipe, both above and beneath them, we placed 6 x 6-inch timbers, slightly lapped. Between the upper and lower 6 x 6-inch cross-timbers we put in fillers around the pipe and tied the entire section of the crib and pipe together by means of 1-inch bolts passing through the ends of the upper and lower cross-timbers. These cross-timbers were placed 3 to 5 feet apart along the entire length of the beam. A double ¾-inch cable was then run from end to end of the U, making a turn around each elbow and running over the top cross-timbers of the crib. The slack in the cable was all taken up by means of turnbuckles provided therefor. The purpose of this cable was to act partly as the tension member of a truss (the tension member being on top, as the ends of our crib would be slightly heavier due to the riser pipes of the U), but chiefly to prevent the joints being blown apart due to any water hammer that might occur. In addition, we carried vertical timbers upward behind the riser pipes of the U from the crib and knee-braced to it, and further strapped and blocked the elbows and risers to it.

"When this had been completed we temporarily bulkheaded the open ends of the elbows with boiler plate and proper fastenings, and tested the line to 90 pounds water pressure. Finding no leaks or weak pipes, we removed the water, replaced the bulkheads, and launched the crib by jacking it out uniformly at low tide on ways previously constructed. The next high tide floated the crib and pipe, which had a net buoyancy of about 12 pounds to the linear foot of

crib. We then took hold of the crib with two derrick lighters, each holding it with a tight line on cable slings previously attached to the crib, giving us four points of support. The outfit was then towed into position in the channel, where guide piles had been driven, two at each end, one on either side of the crib. These piles helped to hold the crib in place against the tide while sinking. The crib was entered between these piles by springing the tops aside. This could easily be done, the 60-foot piles having only about 25 feet penetration. The derrick lighters were kept on the down stream side, where they were anchored and lashed to the bridge fender piles and our pile trestle. We now also took a strain at the center of the crib on a previously attached sling with the pile line of the floating driver. This gave us six points of support for the crib while sinking. Barges were ready at either end of the crib with hot lead and plenty of men, tools and materials. We now removed the bulkheads from the elbows and had a third derrick lighter place the first sections of riser into them. After these pipes were strapped and bolted to the vertical timbers, and the joints run and caulked, we pumped water into the pipe line until the bottom of the U was full. Then, slacking off a little at a time on all three rigs, and always keeping the base of the U level, we quickly sank it until the bells of the first riser sections were at a convenient elevation with respect to the barges. After this, the next sections were placed, run and caulked in the same manner. These last joints had previously had short sections leaded and caulked into them, whose approximate length had been determined by soundings. The whole was then easily lowered to the bottom. We always had complete control. A diver was ready in case of trouble to make an examination, but it was not needed. The bottom had been slightly leveled off with a clam-shell bucket. The top elbows were now placed and connections made to the trestle lines. The last two joints before joining the U were kept above the trestle to allow for settlement of the U. Later, chains which had been fastened on either side of and at each end of the crib, were fastened to the piles to prevent further settlement pulling the riser section apart. The elbows on top were strapped back and down to prevent their being blown off. Cluster piles were driven around the risers to prevent their being hit by boats.

"The channel was blocked to navigation only one-half day, and as shipping had been notified, it caused little trouble. The clearance for ships above our pipe line is about 23 feet at low tide.

"We were able to turn water into the Portsmouth-Norfolk connection on January 30, just 17 days after being awarded the contract. The last three days of this time were put in during the long-prayed-for rain which had finally arrived. Our average force was about 350 men and the experience cost Norfolk close to $100,000.

"The government and city officials and the contractor all worked harmoniously and deserve joint credit for tiding Norfolk over a serious crisis."

Water Consumption in Waltham

Per capita consumption was reduced nearly one-fourth in a year by pitometer survey, stopping leaks so discovered, and metering. A large part of the loss was through stuffing boxes of underground valves.

In his report for the year ending January 31, 1920, Henry F. Beal, city engineer and superintendent of the Water, Street and Sewer Department, gives encouraging reports concerning the reduction of water waste during that year in Waltham, Mass. The total amount pumped for the year was 203 million gallons less than in 1918, decreasing the daily per capita consumption from 78.4 to 59.2 gallons.

A pitometer survey of the entire distribution system was made during May and June, and in addition 765 new meters were installed, making the system 91.2 per cent metered. It was expected that still further reduction in the waste and loss would be effected by continuing the repairing of leaks which had been located by the pitometer survey. It was calculated that the waste of water averaged 51.6 gallons per capita per day in 1918, 36.8 gallons during the first half of 1919, and 29.6 gallons during the latter half of 1919. The waste (the night loss being taken as the amount of waste) was a maximum of 62 gallons in 1913, when 25 per cent of the services were metered, and decreased gradually to 43.7 gallons in 1916 with 53 per cent of the services metered. During the next two years, although the percent of services metered increased to 76.6 per cent, the waste also increased to 51.6 gallons. That this increase was due to leaks in the system rather than waste (to a considerable extent at least) is indicated by the fact that, following the pitometer survey and the repair of leaks discovered by it, the loss was cut down to 32.6 gallons per capita per day. During 1919 the average daily consumption was 1,952,100 gallons, the maximum for one day was 2,477,900, on January 7, and the minimum, on September 3, was 1,677,200.

Following the survey of the system in May and June, the Pitometer Company, under date of June 24 submitted a report giving the following facts and conclusions:

Water is supplied to the system by two pumping stations drawing the supply from wells and pumping into a concrete stand-pipe.

The distribution system comprises 61 miles of mains from 24 inches to 2 inches in diameter.

There are 4,300 services.

The consumption is practically all domestic, business and public, with only a small amount of manufacturing; under which conditions, if the system were fully metered, the consumption should be as low as in the neighboring suburban

cities of the Metropolitan Water District, or about 45 gallons per day.

The survey located some large sources of loss, among these being 250,000 gallons a day lost from leaking stuffing boxes of underground valves. Also 115,000 gallons a day from leaks discovered brought the total up to at least 400,000 gallons. Watering troughs were reported as a source of unnecessary waste, from 20,000 to 35,000 gallons per day being used at each, which was considered much more than was necessary. The leakage around valve stems was reported by districts, four in one district leaking at a total rate of 55,000 gallons a day, four in another district at 40,000 gallons, three in another district at 44,000 gallons, and twelve in another wasting 120,000 gallons per day.

Two 6-inch compound meters were found to be under-registering, one of them 13 per cent and the other 2½ per cent. Other large meters, 24-inch and 12-inch, however, were found to be registering correctly. Of the two pumps, one was found to have no measurable slip, while the other showing a slip of 7.5 per cent.

Comprehensive Water Development for California

A plan for the solution of the water problem of northern California has been proposed by Col. Robert B. Marshall, who was for several years connected with the U. S. Geological Survey. This plan was proposed in March, 1919, in an open letter to Governor Stevens, since which time Col. Marshall has been perfecting the details of the project and making it known to the citizens, and it is expected that it will be presented next winter to the State Legislature.

The plan includes the construction of a series of storage reservoirs in the mountains, with canals on both sides of the Sacramento and San Joaquin valleys, and the reclamation of all available land in these and adjacent valleys, estimated at approximately 12 million acres. Under present conditions the project is estimated to cost between 600 million dollars and 750 million dollars, or a tax of about $50 to $60 an acre on the land reclaimed. It is believed that it would add to the wealth of California ten or fifteen times the cost of the project, while an equal amount would be contributed by the water power development and industrial stimulus. It would also solve the Sacramento river flood problem and provide an adequate municipal supply for the cities around San Francisco bay, Los Angeles and even more distant cities for the next one hundred fifty years. City Engineer M. M. O'Shaughnessy of San Francisco approves the project, referring to the fact that, owing to the depletion of underground waters in Santa Clara valley, the well water condition there is serious, while the orchards will be destroyed unless the level of the ground water can be preserved. He writes that the irrigation development up to date has been confined to efforts by individual corporations and a few local districts, but no broad, comprehensive plan has been considered for the last thirty years and he believes that the time is now ripe for a comprehensive study, including storage reservoirs on both higher and lower levels, hydro-electric power possibilities, canal and other irrigation distribution, and careful estimates of the amount of water available in the different localities. Mr. O'Shaughnessy concludes by stating that California can sustain a population of thirty million people with the proper storing and distribution of the water resources.

To Investigate Elizabeth's Water Supply

The Rotary Club of Elizabeth, N. J., on September 29, on the recommendation of a committee which had previously been appointed, adopted resolutions stating that it viewed with great concern the conditions in regard to the water supply of that city (which is furnished by a private company) and that the mayor and city council be ged to take immediate action.

The committee reported that for some time past actual shortage in the supply had been avoided only by borrowing from neighboring communities and because of the abundant rainfalls of the past three years. Neither of these can be depended upon in the future, and immediate provision is necessary to guarantee a sufficient supply to the city. It recommended that experts be employed to advise with the city as to how the condition can best be met. The water company has stated that it is unable to finance any scheme for an increased supply and it was therefore suggested that the city either purchase the entire plant and rights of the Elizabethtown Water Company or that it finance extensions to be made by that company.

Virginia Highway Statements

The Travelers' Protective Association, Post A, recently asked the state highway commissioner of Virginia, G. P. Coleman, to publish detailed information concerning the activities in his department. With this end in view, Commissioner Coleman has divided the state into sections and has announced that he will give to the newspapers of each section periodical reports upon the roads built in such section.

Sections of roads in the state system which have hitherto been improved by either the counties or the state are now being maintained by the department from the automobile fund, but 75 per cent of the roads are unimproved, and no provision has been made by the general assembly for maintaining them. Practically no funds were available for highway work until the fall of 1919 and the beginning of 1920. Under the previous method of road building, short sections of highways had been built here and there but not connected up, and the connecting up of these into continuous routes will not be possible until funds have been provided that can be used for this purpose.

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CONTENTS

Sewage Treatment Experience

Experience in any line is the best teacher when it is properly apprehended and taken advantage of; and this should apply to sewage treatment as to other matters. Unfortunately, in the United States experience with operating sewage treatment plants has probably been the basis of less advance in the science and art than has that obtained in experimental plants. And yet there can be no question that experience in the former could and should be more reliable and instructive than knowledge obtained from the comparatively short runs of testing plants of temporary construction, no matter what their size. The reason for this condition of affairs is that so few sewage treatment plants are in the charge of competent men with technical knowledge and provided with sufficient assistants and opportunity to keep accurate records of the operation of the plant and study the effect of minor variations of practice in operating it. Too many plants operate without any management whatever that is worthy of the name.

One of the few exceptions to this is the Fitchburg, Mass., plant, the operation of which during its sixth year is outlined in this issue. Each year of these six has taught the superintendent of the plant some valuable lessons concerning the operation of Imhoff tanks, sprinkling filters and others of its features, which information he has generously shared with others through his annual reports. Possibly the most interesting feature of last year's experience was the lessons learned concerning the use of combined sewers for collecting the sewage treated by the plant, which sewers carried considerable grit into the tanks in spite of the use of grit basins and chambers and the presence of a long inverted siphon in the main outlet line leading to the plant; and the effect of this collection of grit in the tanks, including the apparent stimulation of foaming.

When every plant, large and small, is operated and studied with as much care and skill as this one, the science and technique of designing, building and operating such plants will advance much more rapidly and wisely.

Hydraulic Engineering

Probably at no previous time has there been under discussion anything like the number and the magnitude of projects involving hydraulic engineering as at the present. In this country, the Federal legislation designed to promote the development of water power throughout the country, and the dozen or more projects for canals, from the modest ones limited to a county to the ambitious project for bringing ocean steamers by the St. Lawrence canal to the Great Lakes, are familiar to all. There seems to be a similar spirit in European countries also, as well as in South American ones. For instance, under date of October 24 the "French Commission" (a sort of French information bureau to Americans) announces that the Commission des Forces Hydraulique reports nine million hydraulic horse power theoretically available in France, of which 1,165,000 h. p. is in use and 500,000 additional is being equipped, while six million more should be utilized within the next fifteen years, when France would, it was estimated, be third among the nations in water power development. The British information bureau in this country on the following day announced that the British government has begun an investigation into the water power resources of the United Kingdom and has already reported favorably upon nine schemes in Scotland aggregating 183,500 h. p. and recommends that England and Wales be divided into water power districts

with a view to securing the best development of such power.

The utilization of these potential powers involves both promotion and engineering, and the indications are that the development of them into realities will call for a considerable amount of engineering advice and supervision during the next few years, furnishing an excellent opening for those who have made a specialty of hydraulic engineering.

Concrete and Bituminous Pavements in New York State

Under the above heading an article appeared in the September 18th issue of PUBLIC WORKS giving a number of figures relative to highway lettings in New York State, the significance of which appeared to be chiefly that, although the highway commission, in a report published the first of the year, estimated that the cost of concrete and bituminous macadam pavements would be about the same, bids received this year were considerably lower for bituminous macadam than for concrete; and also that there is more difficulty this year in obtaining bids on concrete than on bituminous macadam. We have just received a letter from the first deputy commissioner of the New York State Highway Department commenting upon this article, which communication we publish below.

The writer of this letter cites figures for four lettings made this year, for some reason (which he does not state) omitting all reference to lettings held on May 5, June 7 and July 2, and including that of August 10, the figures for which were not available to us when our article was prepared. This being the case, it is rather remarkable, not that Mr. Schultze's figure differ from ours, but rather that there is so much similarity between them.

Taking the first point, that of cost; his figures show that the average of the low bids at these four lettings was $34,925 per mile for concrete and $18,894 for bituminous macadam. Disregarding the two completion contracts, the bituminous macadam averages $24,330. Making allowance for the different widths of pavements as closely as the figures at hand permit, it appears that the concrete pavements averaged about 15 per cent wider than the bituminous macadam, and adding 15 per cent to the bituminous macadam price, this becomes $27,980 per mile, which is still considerably less than the $34,925. Consequently, the figures of Mr. Schultze's four lettings seem to prove the same point brought out by our figures for all six lettings, that New York builds bituminous macadam highways for much lower cost than it does concrete.

As to the other point, the percentage of bituminous macadam and of concrete projects, respectively, which were bid upon at these lettings, the figures based upon Mr. Schultze's four lettings do not vary considerably from ours for concrete and water-bound macadam, but do vary for bituminous macadam. This might be accounted for by the figures of the three lettings omitted, but as a matter of fact is affected considerably by a difference between his figures and ours for the letting of of March 18, which we are not able to reconcile. His figures show 21 projects in the letting and only 11 bid upon. In the issue of PUBLIC WORKS of April 3 we have given, as received from the department, bids received at this letting which seemed to indicate that of 14 cement concrete contracts offered, 8 were bid upon and that of 6 bituminous macadam contracts offered all were bid upon, instead of only 3, as given in this letter. However, the matter does not seem to us to be a vital one, since the general statement that it has been more difficult to construct concrete roads than bituminous ones during the year 1920 is borne out by the common experience of highway departments and municipalities throughout the North Atlantic states.

As to the thickness of the pavement, Mr. Schultze's letter indicates that most of the concrete pavements averaged 5½ inches thick, although occasional instances are cited of those which averaged 7½ inches. The last sentence in our article, "The bituminous macadam is understood to be 13 inches thick," was not given as a positive statement because we did not have figures showing definitely the thickness, but we had been informed by one of the engineers of the department that last year and this the majority of the bituminous macadam pavements were being made 13 to 15 inches thick.

In view of the above, we must confess that we cannot "appreciate how misleading your article is as to the comparison costs per mile."

Editor, PUBLIC WORKS,
240 West 39th Street, New York City.
Dear Sir:

Referring to your article in the September 18, 1920, issue of PUBLIC WORKS, I wish to call your attention to the following facts, making special reference to your cost per mile used:

In the four lettings helds by the New York State Highway Department, the following table shows the percentage of total mileage bid in 1920, through August 10, 1920, letting; the number of concrete bituminous and water-bound roads in each letting and the number of each type bid upon:

Letting of	Miles Bid on			Miles Not Bid on			% of Total Mileage Bid on		
	Conc.	Bit. Mac.	W. B.	Conc.	Bit. Mac.	W. B.	Conc.	Bit. Mac.	W. B.
Jan. 30	10.43	20.94	15.13	38.90	5.24	0	21	80	100
Mar. 18	38.99	11.82	0	23.32	14.46	6.98	63	45	0
Apr. 16	8.32	2.35	8.34	17.65	10.70	0	32	18	100
Aug. 10	2.71	0	0	0	8.85	0	100	0	0
Total	60.45	35.11	23.47	79.87	39.25	6.98	43	47	77

Letting of	No. of Roads in Letting			No. of Roads Bid		
	Conc.	Bit. Mac.	W. B.	Conc.	Bit. Mac.	W. B.
Jan. 30	14	4	2	6	3	2
Mar. 18	14	6	1	8	3	0
Apr. 16	9	4	1	3	1	1
Aug. 10	3	1	0	3	0	0
Total	40	15	4	20	[illegible]	[illegible]

At four construction lettings held previous to September 18, 1920, by the New York State Highway Department this year 43 per cent of the mileage of cement concrete pavements offered was bid upon, 47 per cent of the bitmuinous macadam mileage, and 77 per cent of the water-bound macadam. There were 40 cement concrete roads, of which 20 were awarded; 15 bituminous macadam roads, of which 7 were awarded; while bids were received on 3 out of 4 water-bound roads.

Averaging the engineer's estimates of all of the roads and the figures of the lowest bidder for each contract awarded, we find the average engineer's estimate per mile for concrete on the 40 roads advertised to be $35,919 per mile and on the 15 bituminous roads to be $24,653. The average of the low bids on the 20 concrete roads is $34,925 per mile; on the 7 bituminous macadam $18,894. However, of the 7 bituminous macadam contracts, 2 were completion contracts with 71 per cent and 54 per cent approximately of the work done by former contractors. Disregarding these two completion contracts and averaging the low bids of the 5 new bituminous contracts, the cost per mile is $24,330.

In the January 30th letting the engineer's estimates on concrete showed an average of $33,245 for 14 roads and the low bids on 6 contracts averaged $35,813. In the March 18, 1920, letting on 14 roads the average was $35,-714 for the engineer's estimate and on the 8 contracts bid the average of the low bids was $31,597 per mile. In the April 16, 1920, letting on 9 concrete roads the average of the engineer's estimates was $38,752 and for the 3 roads awarded the average of the low bids is $39,234 per mile. In August 10, 1920, letting the average of the engineer's estimates on the 3 concrete roads was $66,226 per mile and an average of the low bids on the 3 roads was $66,158. The high average was due to extra wide pavement as shown in detail later.

The average cost per mile on concrete and bituminous macadam cannot be compared on account of various factors differing for each type. For instance, in the January 30th letting, of the 6 concrete let, 2 were 16 feet wide while 4 were for greater widths up to 38 feet wide and for a short stretch as high as 56 feet. The bituminous macadam widths for three roads let were 12, 14 and 16 feet. Multiplying the length and width of each road for each type and dividing by the total length, the concrete roads show an increase in width of approximately 18 per cent. The thickness of the concrete pavements ran 5-6-5 inches parabolic on two roads and 6-8-6 inches on four and all were reinforced. The thickness of the road metal for bituminous macadam ranged from 6 inches to 12 inches.

In the March 18, 1920, letting the 8 concrete roads let were all 16 feet wide and the 3 bituminous macadam roads were 14 feet wide. All concrete thicknesses but one were 5-6-5 inches and all were reinforced while the road metal thickness on the bituminous roads ranged from 6 inches to 11 inches.

In the April 16, 1920, letting the 3 concrete contracts let were, respectively, 16, 16 and 18 feet in width and the thickness ranged from 5-6-5 inches for the smaller to 6-7⅛-6 inches for the larger width. The one bituminous road let had a road metal thickness of 11 inches and was 14 feet wide.

In the August 10, 1920, letting the 3 concrete roads let varied from 16 feet to 48 feet, with the larger percentage of widths over 16 feet. The thickness ranged from 6 inches minimum to 8¾ inches maximum.

The article in PUBLIC WORKS in the September 18, 1920, issue is open to severe criticism principally on account of the unbalanced comparison. To arrive at a cost per mile of concrete roads and compare same with a mile cost of bituminous road of lesser width gives no relative comparison and such miles costs are decidedly untrue. The average of the thickness on the 7 contracts awarded previous to September 18, 1920, is under 11 inches, and in no case was there a bituminous macadam contract let with a road metal thickness of 13 inches, as mentioned in the last line of the September 18th article.

With the above information at hand, you can readily appreciate how misleading your article is as to the comparison costs per mile.

We believe, however, that PUBLIC WORKS has no desire to give other than the true information, and feel sure, upon receipt of the above figures you will be glad to correct the impression which your article gives.

Yours very truly,
STATE HIGHWAY COMMISSION,
By Paul Schultze,
First Deputy Commissioner.

The A. S. M. I. St. Louis Convention

It was our intention to give in this issue the conclusion of our description of the St. Louis convention of the American Society for Municipal Improvements, but this is prevented by the loss of the manuscript by the printer. We hope to give it next week instead. Below we reproduce a photograph of the exhibits at the convention. The arrangement and decoration were unusually effective.

EXHIBIT HALL OF THE A. S. M. I. CONVENTION IN PLANTERS HOTEL, ST. LOUIS

Hoisting and Conveying System For Heavy Trench Work

Equipment installed for handling large amount of heavy materials for deep open excavation and subway construction

The construction of the Interborough Subway System in Manhattan, Brooklyn and Queens Boroughs presented many diverse problems of engineering and permitted the adaptation of various types of construction plant to offset the diminished and high-priced labor supply which confronted contractors during the war.

That portion of the subway system known as the Eastern District Section in Metropolitan and Bushwick avenues, Brooklyn, was constructed by a company formed of a combination of the Mason & Hanger and MacArthur Bros. firms. Edgar A. Groves, chief engineer of Mason & Hanger Co., was in charge of the work and plant layout.

This section of the subway joined the eastern portal of the 14th street tunnel under the East river and consisted principally of cut and cover work, involving an average excavation of approximately 50 feet. It was necessary to excavate the soil, remove it to the waterfront by trucks and handle concrete, steel and other materials.

A system of overhead lateral conveyors was devised and installed over the work, dismantled and re-erected as the work progressed. This system was a ramification of the suspension cableway plant of which the S. Flory Mfg. Co. was the pioneer builder and which it has installed on many prominent engineering projects, such as the Kensico dam and Gilboa dam of the Catskill aqueduct, New York State barge canal, etc.

These conveyors were made of yellow pine timbers supporting a central I beam track, on which a trolley carriage traveled, the conveying rope being attached to each end of carriage. Two sheaves were placed in the lower portion of the carriage for handling the hoisting line and fall block with hook. End-dump buckets were used to handle excavating materials from the cut to the trucks and concrete from the mixers to the job.

Each of the four plants was operated by a 50 h. p. Flory double tandem friction drum electric hoist with friction and brake levers arranged in a battery alongside of controller. The hoists were geared for a traversing speed of 300 feet per minute, hoisting on a two-part line at 150 feet per minute. The conveyors were from 200 to 300 feet long and handled loads up to 5 tons.

The plants were operated continuously for four years, at times for 24 hours a day. The cost of repairs on the four hoists for the entire period did not exceed $200 and the contractors state that the machines were in first-class condition at the completion of the work.

Movable Construction Trolley Line

About 300 trains per day, each made up with ten 16-yard and 20-yard side-dump cars, delivered 24,000 yards of earth and rock spoil to a 245-acre dump yard that was being filled in to a maximum depth of 60 feet with part of the 15,000,000 yards of excavation from the Queenstown-Chippewa power canal near Niagara Falls.

The spoil was hauled about two miles from the center points of the canal by 50-ton electric locomotives on standard gage, well-ballasted double tracks that were shifted transversely to allow the bank to be built out. The locomotives were operated by a trolley line supported on horizontal cantilever beams that projected 7 feet beyond the faces of the A-shape towers to give clearance for excavating machines between the latter and the track.

In order to conform to the varying positions of the track, the towers were each mounted on four flanged wheels that ran on short sections of light track which were taken up in the rear and laid down in advance as required.

Grooved Spikes

Grip spikes 6 inches long under the head and ⅝ inch in diameter with longitudinal grooves making four slightly twisted wings extending nearly full length, have been tested at Columbia University together with plain spikes and screw spikes driven into solid wood and also into ½-inch holes.

Compared with a cut spike driven into solid wood as 100 per cent, cut spikes in a hole develop 93.1 per cent, grip spikes 129.3 without holes and 122.7 with holes, and screw spikes with holes 172.9. Various woods were tested and maximum result was for a screw spike driven in a hole in white oak timber that developed a holding power of 15,560 pounds. The next best result was with grip spikes in a hole in white oak timber developing 11,800 pounds against 10,300 pounds in the same timber without a hole. The cut spikes driven in the same timber with a hole developed 8,700 pounds and without a hole 9,020 pounds. The poorest result was for a cut spike in a hole in Douglas fir developing 3,539 pounds.

Additional experiments made by driving the spike, pulling it ¼ inch and then repeating the operation twice so as to approach the condition of track spikes that worked loose and are re-driven, showed that the grip spike was 29 per cent more efficient than the cut spike and that the screw spike was 78 per cent better than the cut spike in chestnut ties.

Deep Foundation Sheeting Eliminated

The excavation for a land pier of the seven-span highway arch bridge over the Miami river at Hamilton, Ohio, has been satisfactorily accomplished by a dragline machine without requiring the driving and pulling of steel sheet piles and the hand excavation and direct hoisting of materials often involved in work of this nature. The 28 x 62-foot concrete pier has a footing of 150 wooden foundation piles, cut off 26 feet below

water level in the adjacent river. The soil consists of 10 feet of river gravel and 4 to 8 feet of clay overlying the stratum of cemented gravel at the bottom of the excavation.

As there was plenty of available room and no adjacent structures to be endangered, no attempt was made to retain the sides of the excavation, and the material was removed by a class 14 Bucyrus machine with a 60-foot boom and a 1½-yard bucket working under water that dug the pit with the required bottom dimensions and with side slopes of about 1 on 2. Although this involved three or four times as much excavation as would be required for a sheeted pit, the total cost was less and the work was more satisfactory than it was estimated would be the case with sheeting and clamshell or hand digging.

After the excavation had been completed, the water was pumped out for a fortunate rise in the river at about the same time brought down so much sediment that the flow through the upper stratum caused it to silt up rapidly and the seepage into the pit was soon diminished 50 per cent. No difficulty was encountered in keeping the pits dry while the foundation piles were driven and cut off, forms erected, and the pier concreted.

Pay on Georgia Highway Work

The County Board of Roads sitting at Rome, Ga., has adopted a resolution providing that labor on road work be paid $2 a day and $5 be paid for a team and driver.

Virginia Appoints Board of Examiners

The governor has made the following appointments to the Virginia State board for the examination and certification of architects, professional engineers and land surveyors: P. M. Winfree, engineer, Lynchburg; James F. MacTier, engineer, Roanoke; John Kevan Peebles, architect, Norfolk; Fiske Kimball, architect, University of Virginia; W. C. Noland, architect, Richmond; Thomas M. Fendall, surveyor, Leesburg; L. B. Dutrow, surveyor, Petersburg; W. D. Tyler, engineer, Dante; C. G. Massie, Amherst. At the organization meeting, held September 17, Mr. Kimball was elected president and Mr. Dutrow, secretary pro tem.

Licensing Engineers in North Carolina

The North Carolina Society of Engineers is advocating the licensing of engineers and surveyors by the state and is drafting a law to be presented to the 1921 session of the legislature providing for a board of examiners to issue licenses to those found qualified. It is proposed to include all forms of engineering, civil, mechanical, electrical, mining and others, and also architecture. It is not intended that it shall conflict with the state laws licensing architects and public accountants.

One of the strong arguments advanced by the engineers for this law is that similar laws already exist in eleven states as to engineers and eighteen states as to architects; and if this number should increase, as seems possible, incompetent engineers who are not able to obtain licenses in other states will naturally concentrate in the states where such licenses are not required.

Labor Notes

Inquiries made by the Industrial Bureau of the Merchants' Association show that in New York City factories there is a slight surplus of unskilled male labor and a marked deficiency of female labor of the same class. It is reported that common laborers are more abundant than at any time since pre-war days, and that whereas a few months ago only half the number required could be secured for given jobs, now all can be obtained easily.

This condition is considered partly due to the extreme high prices, which have caused the discharge of many male workers. The shortage of female workers is attributed partly to the shortage of immigration, to the prejudice against factory work, and largely to the fact that the high wages paid to men make it unnecessary for women to work.

The exodus of Jews from Poland has been increasing so steadily for weeks that the Polish Army Office predicts that it will soon number more than 250,000, of whom most are bound for America.

A French officer attached to the French Military Commission in Poland stated that his government has adopted a policy of expediting the departure from France of a large number of Jews going to America.

Information received by the Immigration Department indicated that as soon as peace is officially declared between the United States and Germany hundreds of thousands of German immigrants will attempt to come to this country in the steerages of all New York bound steamers.

In discussing the labor and wage situation, the "Industrial News Survey," published by the National Industrial Conference Board, says:

"Although no general tendency toward lower wages has yet appeared, there is a noticeable trend of sentiment that recessions cannot long be delayed.

"Railroads, at several important terminal points, announce reductions in their working force, and the men released constitute a measurable increase of labor supply.

"On the whole, however, unemployment is comparatively light, and the expectation of lower wages that is voiced here and there, comes from a belief that the peak has been passed in the cost of living and in speculative profits, and that the lower range of profits will not permit, nor the

lower costs of living necessitate, the present high scale of wages generally.

"Steady improvement in efficiency of labor is reported in Mahoning Valley steel industries; some plants," the report says, "are operating with 20 per cent less men than during the war, and have reached a pre-war rate of production. Foreign-born workers, who went to Europe during the steel strike and who are returning, show," says the statement, "a decidedly new interest in their work."

The Employers' Association of Detroit, Mich., reports that during the week ended October 5th there were 10,108 workers laid off in the factories of that city and 953 added; leaving a net decrease of 9,155 for the week. Present working force of shops included in report is 166,953, a decrease since April 1, 1920, of about 16 per cent.

Out of a class of 25 aliens, 22 were recently graduated in Elizabeth, N. J., and presented with diplomas in the citizenship course conducted by the Sons of the American Revolution under the auspices of the Young Men's Christian Association.

The Japanese Question

Dislike and distrust of Japanese immigrants is becoming stronger and stronger on the Pacific coast, especially in California, where violent objection is being made not only to the arrival of more Japanese immigrants but to privileges that have been accorded to those already here. A referendum will be held this fall to determine whether legislation shall be enacted preventing the acquisition of land by purchase by Japanese. This is said to be very offensive to Japan and even assumed by some to endanger diplomatic relations between America and Japan. It is charged that the Japanese wilfully depreciate value of the land on which they are employed or hold leases, so as to purchase it below value, thus driving out American owners and operators and dishonestly acquiring their property.

The prohibition of Japanese immigration is strongly urged and has been taken up to some extent throughout the other states of the Union, from nearly all of which there have come an unusually large amount of notices on this subject, the majority of which are opposed to the Japanese. This is, of course, largely through sympathy with the Californians and through the efforts of the labor organizations, who are opposed to Japanese and all other immigrants who may tend to break their monopoly and bring wages down to a normal level.

Japanese statesmen have proposed the appointment of a commission to come to America and confer with the Federal authorities but doubt is expressed whether the latter will accept this proposition. It is admitted by the Japanese that the exclusion of immigrants and prohibition of alien's land ownership is entirely legal and does, indeed, correspond with measures that the Japanese have already taken with respect to citizens of foreign nations, including the United States.

Paving Mixer Delivers 440 Four-bag Batches in 9½ Hours

Record made laying 779 lineal feet of 16-foot by 8-inch concrete pavement in one shift with 32 men.

A new world's record was established by Alan Jay Parrish, the prominent Illinois highway contractor, on June 30, 1920, when, with a 21-E Smith Simplex Paving Mixer, he laid 744 lineal feet of concrete road, 16 feet wide, 8 inches thick, on a million and a half dollar contract near Paris, Ill.

This remarkable run was made in 9½ hours, using a four bag batch and allowing a full minute mix on each batch The average time, throughout the entire day, for mixing and placing each batch, was just 75 seconds. The complete cycle of mixing operation ran from 70 to 72 seconds. Considering the fact that a full minute of mixing was required, this allowed 10 to 12 seconds for the loading and placing operation—the speediest average ever recorded on a complete day's run.

On August 6th, 1920, Mr. Parrish broke this record by laying 779 feet on that day, after having averaged considerably over 600 feet per day for more than a week.

SYNCHRONIZED OPERATIONS

The operations of the big paver were so synchronized that the discharging time and the skip-raising time were perfectly balanced. When the operator pulled the discharge lever, he also engaged the skip-raising lever. Thus the drum was completely emptied by the time the loaded skip, fully raised, began to reload the drum for the next mix. Not a moment was wasted. A second after the mixed batch was discharged, the material for the next batch was sliding into the drum of the paver.

In loading the skip with the aggregate from the "turn-over" batch boxes, the time-agreement in the movements of the skip and the derrick helped materially in avoiding unnecessary loss of any seconds. The movements of the derrick with which this paver is equipped are controlled by the movements of the skip. The derrick cable works over a drum on the skip-hoisting so that, as the loaded skip is raised, the derrick-hooks lower. When the skip is completely raised the derrick-hooks are fastened to the loaded batch box; then, as the skip lowers, the derrick cable rises, lifting the loaded batch box to just the proper height by the time the skip has reached the ground.

Two men swing the batch box into position and dump its contents into the skip. Then the skip is raised and the derrick-hooks lower away the empty batch box to its car on the industrial train. During the minute of mixing, there is ample time to spot the batch box cars in position for the derrick to grab the next loaded box.

STORING AND HANDLING MATERIALS

The installation of all the plant and handling of materials were all carefully arranged for speed.

The yards are located about a mile from the road under construction. The sand and stone are unloaded from the cars by a one-half yard, full revolving Erie Crane, operating on a track parallel to the unloading siding. The crane deposits the material in piles alongside the 24-inch Industrial Railway loading track and also fills the storage bins.

The industrial cars, each with two batch boxes, start at the loading bins, where the proper proportion of sand and stone is loaded. The train then moves by gravity to the cement loading platform, where the cement is added to each batch box. Plymouth 3-ton locomotives then haul the trains to the paver. After the trains once start through the loading process they travel continuously toward the job.

Each locomotive handles ten cars, carrying twenty batches. At no time during the day was there any delay in waiting for the next train to pull into position. A train was always ready on the siding. During the 9½ hours that the paver ran, 22 train loads carried 440 four-bag 1:2:3½ batches.

GRADE, TRACK AND FORMS

An important detail that was dealt with in a particularly careful manner was the method in which Parrish prepared the grade for his Industrial Railway system. He has found from experience that a carelessly formed grade may eventually cause expensive trouble through derailments and delays. So this grade was built up properly and so thoroughly drained before any steel was placed upon it that, in laying over a mile and a half, so far, on this contract, there have been only two minor derailments.

The placing of the railway sidings was planned so that it would be always possible to have the train load of batch boxes at the paver just when the material was needed.

After completing a mile and a half of the pavement, the paver was moved back to the starting point and reversed, to work in the opposite direction, thus reducing the length of the haul from the original loading station. The track was left on the same side of the road, the only change required being to move the derrick to the other side of the paver.

The latest models of Heltzel Steel Forms were used and the tamping and finishing was handled by the new Parrish Tamping Machine.

28 WORKINGMEN

The crew consisted of: 2 crane men, 4 men loading batch boxes—stone, sand and cement, 4 train men, 8 grading crew men, 2 men ahead of paver, handling batch boxes, 1 engineer, 1 fireman, 3 men spreading concrete behind machine, 1 tamping machine operator, 2 men spading and edging, 1 superintendent, 2 foremen, 1 waterboy —total 32 men.

Mr. Parrish states that by using a five-bag instead of a four-bag batch with this paver, he expects to increase the record considerably.

Prices of Materials of Construction

Market conditions and available supply of timber, steel, cement and masonry materials. Written for the October 2nd issue of "Public Works" but omitted for lack of space.

Except for excavating, grading and a few cases of tunneling, construction operations always require considerable amounts of standard manufactured materials, the scarcity, high price, or uncertain delivery of which have, for the last few years, greatly impeded and discouraged construction in many parts of the United States. The great importance of labor economy and efficiency is inseparable from the provision of materials necessary for the execution of the work. The present conditions and recent developments affecting the cost and availability of the most universally used construction materials are, therefore, outlined here in connection with the review of labor conditions and prospects.

The most indispensable materials for all kinds of exterior construction are wood, steel, cement, sand and stone. All of them (except sometimes sand and gravel, which, at least, require labor and equipment for production) are subject to manufacturing process before being used in construction. Besides being subject to increased costs due to war emergency and accompanying economic conditions of the last five years, all these materials have been made more expensive, some of them to an unheard-of degree, by sudden great demands for emergency work for the army and navy and by the increasing wages of the labor required for their production, which has been maintained and increased long after the end of the war. In addition, the market was greatly upset by the priority orders and the discrimination against construction work classified as non-essential, which operated to discourage business and interfered with stocks; while deliveries have long been demoralized and delayed even to the point of complete failure by the congested and inadequate transportation.

These reasons have occasioned a temporary state of insufficient and uncertain supply with exorbitant prices. Improvement has, however, been established and is progressing so that contractors will be able to estimate safely on reduced cost and reliable supplies, which condition will probably improve steadily and greatly promote important construction, for which the necessary labor will be available with better and better quality and amount.

TIMBER

Since the beginning of the war, the timber supply has suffered perhaps more than any of the other construction elements, not only because it alone is, under normal conditions, a rapidly vanishing product which has steadily advanced in price, but also because of the longer and longer

hauls required to deliver it to the consumer; its universal application and easy adaptability to almost all construction purposes and many other uses; and the fact that it was used in vast quantities for shipbuilding and other emergency work which, under normal conditions, would have used other materials.

The forest depletion has reduced the area of forest lands in the United States from about 822,000,000 to 463,000,000 acres, exclusive of low-grade woodland and scrub. Of the remaining forest area, only about 30 per cent, or 137,000,000 acres, is virgin forest, the remainder being second-growth timber or territory not restocking. The total volume of standing timber in the country, including both saw timber and cord wood, is estimated at about 745,000,000,000 cubic feet, of which more than one-third is cord wood. The per capita lumber consumption of the United States increased from 230 board feet in 1900 to a maximum of 516 feet in 1906, decreasing to 430 feet in 1913 and 300 feet in 1918, when the total cut was 32 billion feet.

Considering the average annual cut as 40 billion feet, it is estimated that 28 billion feet are used for general building and construction purposes, the remainder being used for railroad ties, manufacturing, etc.

From 1914 to March, 1920, average mill prices in the South and West increased 300 per cent and over, while the average retail prices increased from 150 to 200 per cent in the Middle West, and from 200 to 250 per cent in the East. These prices bear no close relation to the cost of production and distribution, although the cost of production has doubled since 1916.

The total annual growth is estimated at about 1,660,000,000 cubic feet. The amount of yellow pine cut is about three times the annual growth and it is estimated by authorities that in 1930 the production of yellow pine wil be reduced nearly 6 billion feet, namely to about 9 billion feet, equivalent to a yearly decrease of more than 3½ per cent in this timber alone.

In order to insure a permanent and adequate timber supply the United States Forest Service recommends prevention of forest fires and extension of national forests, which, it is believed, can be made adequate for future needs.

It may, therefore, be anticipated that while timber supply will be more reliable and prices will be reduced with a general approach to normal commercial conditions, prices will remain high and economy of timber and substitution of other construction materials will be necessary.

In 1918 the total production of lumber was 29,362,020,000 board feet, a reduction of 11.5 per cent from 1917.

The report of the Southern Pine Association for July, 1920, showed that on July 1, 1920, the stock on hand in 200 mills in this district amounted to 1,221,880,035 feet, which was 40.60 per cent greater than one year previously, and that production during the month of July was 75.58 per cent and the orders 80.33 per cent of normal.

In March, 1920, quotations for 12x12-inch timber in New York, Chicago and St. Louis were, respectively, $71, $75 and $60. In September, 1920, the corresponding quotations were $65, $72, and $57.50.

STRUCTURAL STEEL

The supply of steel, depending primarily on the practically inexhaustible ore deposits, is a more direct function of labor and demand, and while the supply for several years has been adequate for all requirements and the actual cost has been reduced by improved methods and equipment and large-scale manufacture, the price remained fairly constant until the war conditions, operating as in other great commodities, increased labor cost of production, made heavy demands for emergency work and deranged regular markets so that prices were gradually increased; but they have been materially reduced since the close of the war, notwithstanding the heavy loss and reduction of product caused by the recent unsuccessful steel strike. Shipments have, of course, been greatly delayed and at times even prohibited by priority orders and the present inadequate transportation, but there is no doubt that the supply will be ample, deliveries reliable and prices proportionate to general conditions for future business.

Market quotations for March, 1920, were, for beams, channels and angles, $2.45, and for plates $2.65, at mills in Pittsburgh; $3.97 and $4.17 in New York; $4.04 and $4.24 in St. Louis; $3.97 and $4.17 in Chicago; and $5.40 and $6.30 in San Francisco. Concrete reinforcement steel from $2.35 to $2.85 at Pittsburgh mills. In September, 1920, the corresponding quotations were: beams, channels and angles, $2.45, plates, $2.65 at Pittsburgh mills; $4.58 and $4.78, New York; $4.04 and $4.24 in St. Louis; $3.97 and $4.17 in Chicago; and $6 and $6.60 in San Francisco. Concrete reinforcement steel from $2.35 to $2.85 at Pittsburgh mills.

PORTLAND CEMENT

Portland cement is manufactured from stone and clay in about one hundred different localities in the United States, chiefly located in the Mississippi valley, Lake region and the Middle Atlantic states. The amount produced annually has increased from 42,000 barrels, valued at $126,000, in 1880, to 88,230,170 barrels, valued at $81,789,368 in 1914, with a total product since 1870 of 770,518,231 barrels, valued at $736,588,922.

On account of the imports and exports, the total quantity consumed in the United States varies from the production and in 1914 was computed to be 84,418,665 barrels, at a price ranging from 71.07 cents in the Kentucky and southern Indiana district to $1.352 in Utah. The average price per barrel at the mills was $0.92, representing a decrease of $0.078 from the average of 1913. During 1915 there was no violent change in the cement market, the average price falling to 86 cents and the consumption being 0.83 barrels per capita compared with 0.77 barrels in 1914. The production was about 66 per cent of the manufacturing capacity. In 1916 production was 68 per cent of the capacity and the average price rose to $1.103 at the mills and the consumption per capita was 0.89 barrels.

In 1917 the production rose to the unprecedented amount of 93,000,000 barrels, although it

reached only 68 per cent of the increased manufacturing capacity. The consumption per capita was 0.84 barrels and the average price was $1.354.

In 1918, although the Government requisitioned about 11,000,000 barrels, the commercial demand was so much reduced that the production was only 70,915,508 barrels, at an average price of $1.596, and a per capita consumption of 0.64 barrels, utilizing only 51 per cent of the total manufacturing capacity. During the five years of the war the average annual production was nearly 86,000,000 barrels, which was greater than that of any year previous to 1913, but was far short of the manufacturing capacity of 130,000,000 barrels, and there was a great fluctuation of prices which varied from 59 per cent below to 110 per cent above the price in 1913. The total estimated production of Portland cement in 1919 was about 80,287,000 barrels and the average price per barrell at the factory $1.69.

In March, 1920, Portland cement was quoted at $2.80, $2, $2.20 and $2.63 in New York, Chicago, St. Louis and San Francisco, respectively, and in September, 1920, it was quoted at $4.22, $2.15, $2.85 and $2.88 per barrel in the same cities.

It is evident that, with the ample manufacturing capacity and the great steady regular consumption, there will be an abundant supply of Portland cement and the prices may be expected to be consistent with the cost of production and reduced to correspond with the gradually modified cost of labor and transportation. One of the greatest difficulties with cement has been the impossibility of securing satisfactory deliveries on account of the discrimination against it on priority orders and the universal deficiency and congestion of railroad transportation. With improved railroad conditions, these difficulties will be diminished and constructions in 1921 should not be much delayed or restricted on account of cement.

CONCRETE AND MASONRY SUPPLIES

Cut stone, broken stone, brick, sand and gravel are widely distributed and involve comparatively little mechanical plant for their production. The principal elements of cost are, therefore, labor and transportation, and with the improvement in these lines, delivery will be more rapid and reliable and prices will be lower.

For a large amount of important construction, especially such as dams and reservoirs, manufacturing and transportation costs can be eliminated by the use of pit sand and gravel excavated near the sites, and this feature, of course, obtains with many road-building operations.

The market quotations for March, 1920, gave the following prices for sand and gravel, and for crushed stone: $2.25 and $1.85, New York; $2 and $2, Chicago; $1.75 and $1.65, St. Louis; $1.50 and $1.50, San Francisco. Brick, per thousand, $25, New York; $14, Chicago; $16, St. Louis; $15, San Francisco. For September, 1920, the prices were: Sand and gravel, $3; crushed stone, $1.90 in New York; $2.15 and $2.35 in Chicago; $1.50 and $1.90 in St. Louis; $1.50 and $1.50 in San Francisco. Brick, per thousand, $30.75 in New York; $16 in Chicago; $16 in St. Louis; $18 in San Francisco.

New York-New Jersey Vehicular Tunnel

Impressive ceremonies attended the official breaking of ground, October 12, at Canal and West streets, New York, for the vehicular tunnel to connect Manhattan Borough with Jersey City.

This tunnel, which has been the subject of long controversy and dissension as to its dimensions and capacity, will probably cost $30,000,000 or more, which is to be equally borne by New York and New Jersey. The design and supervision are in charge of chief engineer C. M. Holland and a board of consulting engineers, Colonel W. J. Wilburs, chairman. The contract for this work was awarded to Holbrook, Cabot & Rollins, New York and Boston.

The first work will be rectangular shafts, in the bottom of which excavating shields will be assembled and the actual driving of the tunnel commenced.

Contract number 1 for the tunnel construction was awarded to T. B. Bryson, New York, for $650,802.50 in competition with four other bids, the highest of which was $1,204,220. This contract is for the construction of two 47 x 42-foot 4-inch steel and concrete shafts 55 feet 4 inches in extreme depth, and some auxiliary work. The shafts are essentially duplicates with concrete walls 5 feet thick with steel plates on inner and outer surfaces and are stiffened by horizontal steel girders. They are to be sunk under pneumatic pressure applied in working chambers 7 feet high, built integral with the walls.

The bid was awarded on unit prices for fifty-eight items, including estimated quantities of 11,410 yards of earth and rock excavation at prices varying from $6 to $8 above water level and $20 per yard below water level; 4,205 yards of concrete at $15 to $21 per yard; 1,120 barrels of Portland cement in grout at $4.50 to $5.75 per barrel; 1,190 tons of steel in the caisson at $282 per ton, and $22,000 for building and equipping an engineer's field office.

Proposed Lake Erie-Ohio Barge Canal

A board of army engineers is now making preliminary investigations of the proposed Lake Erie-Ohio river barge canal that is indorsed by the Inland Waterways Association.

So far four distinct routes have been suggested, namely, from Ashtabula to Pittsburgh, from Cleveland by way of Akron to Marietta, from Toledo by way of Dayton to Cincinnati, and from Sandusky by way of Columbus to Portsmouth. The last is called the Great Central Route and asserted to serve the largest number of people and the wealthiest country, provide the most direct route and reach the coal fields of West Virginia, Southern Ohio and Kentucky.

A bill has been prepared to authorize preliminary surveys of the four routes and provide for funds to be raised by taxation in an area 25 miles wide on each side of the canal and 60 miles wide at the terminals.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Low Cofferdams on Hard Bottom

Culverts and highway bridge piers are among the structures most frequently required to be built in shallow water where the bottom may be solid rock, boulders, or any hard stratum with either a smooth or an irregular surface.

If the water is not swift or exposed to waves, and if the bottom is not very irregular or subject to an upward flow of water cofferdams can generally be constructed, unwatered, and maintained by the use of ordinary materials and methods but at a cost and time generally greater than required for a hard earth or sand bottom.

The principal difficulties encountered are likely to be in securing stability of the cofferdam, in sealing the joint between the cofferdam and the bottom, and in preventing the upward flow of water through the bottom inside the cofferdam.

COFFERDAMS ON SMOOTH ROCK

If the depth of water is only 1 or 2 feet, an efficient cofferdam may be constructed of a wall of sand bags two or three times as thick at the base as it is at the top, and covered on the outer face with earth or clay or a mixture of clay and sand.

If the cofferdam is for important service or a long period, it may sometimes be advantageous to substitute burlap bags of concrete for the sand bags. If such a wall is properly built, the concrete will exude through the meshes of the burlap and firmly cement the bags together, making, when the concrete is set, a solid, well-bound wall. The bags should be filled not quite full of concrete so that they will adjust themselves readily to each other, pack close together, and fill the irregularities in the surface of the rock.

CRIB COFFERDAMS

For water more than 2 feet deep the most ordinary type of cofferdam on a rock bottom is made of bottomless wooden cribs constructed in position or floated to place, sunk to bearing on the bottom, filled with stone or sand, and made tight by an embankment on the exterior.

The cribs, which are to give stability to the structure and retain loose materials, may be made of sawed or round timber and as they are not themselves expected to be water tight, are constructed in the most rapid and economical manner, often being laid up cob-house fashion with open spaces between the successive courses of timbers, which are crossed at the corners. Pockets are provided in them to contain sand or stone by which they are sunk to position, end to end, as closely together as possible. Afterwards they are filled with stone or earth or both, and a bank of clay or other material as impervious as possible is made on the outside, covering the adjacent surface of the rock and the face of the cribs, and is maintained in position by the cribs. If subject to erosion, the sloping surface of the bank should be riprapped.

Sometimes vertical planks, close together, are placed on the outside faces of the cribs, driven down to hard contact with the rock and nailed in position, thus closing the larger openings between the bottom and the cribs, and making the cribs form of themselves an approximately water tight wall. If these planks extend above water level, and if they have tongue and groove joints they may exclude a large part of the water. Obviously a second row of similar planks may be placed on the inner face of the cribs and will then still further reduce the flow of water, although in this case the pressure of the water tends to push the planks away from the cribs, instead of holding them more firmly against the cribs, as on the outside.

If the lower ends of the vertical planks are beveled to a knife-edge and the planks driven down hard with heavy mauls they will broom up against the rocks and make a closer joint with the irregular surface.

If the surface of the rock is covered with a few inches or more of mud, clay or sand, the planks should be driven through it to the surface of the rock.

BAD BOTTOM

If the surface of the rock is inclined from the horizontal or if the current is swift, it may be necessary to anchor the cribs to rock by steel dowels, holes for which can be drilled through very shallow water by ordinary jack-hammer drills operated by men wading in the water. If the water is deeper, the drilling will be much more expensive, and will require some system of mounted drills with long steels and the holes may have to be protected by casing pipes.

If the surface of the bottom is very irregular, it should be leveled up as much as possible before the cribs are sunk in position. Some of the high points may be broken off and the low places filled with clay dumped in or with sand or with concrete bags, piled up by men working in shallow water or handled by ropes and poles in a

little deeper water. After the cribs have been set, large cavities found under them can be filled by bags carefully worked into position from either side of the crib.

If the bottom is covered with boulders and loose rock it is very difficult to construct a watertight cofferdam on them, and the bottom should be cleared by drags, scrapers, grapples, and blasting, if necessary, to make as even a surface as possible for the bottoms of the cribs. Careful soundings should be taken and an accurate profile of the bottom made at both the upper and lower edges of the cribs, and the latter should be built to correspond, so as to fit closely when sunk in position.

SPECIAL TREATMENT

Unless the water comes up fast through the bottom inside the cofferdam, the latter can usually be made tight enough to be unwatered by liberal embankments of earthy material on the exterior. In extremely bad cases a double line of cribs can be made and the space between them divided into short sections successively filled with puddled clay.

When serious leaks have occurred between the crib and the rock bottom they have sometimes been overcome by an apron of heavy canvas or equivalent material, nailed to the lower part of the vertical face of the crib and having a strip several feet wide spread out horizontally over the rock bottom and covered with earth or clay to hold it securely down in position and exclude the water.

Very small cofferdams can be made, as for soft bottom work, with complete bottomless, tight-wall boxes of wood or steel, set in position as units. The lower edges should be fitted as closely as possible to the surface of the rock, and they can be provided with canvas aprons covered with earth or clay to seal the joint on smooth bottoms.

In some cases, if the design of the structure and local conditions permit, the foundations may be built in sections so as themselves to form parts of a cofferdam in which the remaining sections can be constructed. This method reduces the amount of surface exposed to water and provides regular and stable support for the temporary sections of the cofferdam.

STOPPING LEAKS

Generally the cofferdam must be unwatered by pumping, and if it leaks badly it may be necessary to maintain the pumping continually to keep the water down. If large quantities of water rise through the bottom, the leaks may sometimes be reduced by driving soft pine wedges into cracks in the rock or by filling them with masses of concrete heavy enough to resist upward pressure. For very important work it may be advisable to drill holes in the rock and force in grout under pressure, as is sometimes done for dam foundations, but this, of course, is a slow, costly and uncertain method. If either grouting or concreting is practiced it should be done when the cofferdam is full of water and the cement allowed to set at least 24 hours before pumping is commenced.

Leaks in the cofferdam can be stopped by patching and puddling. Leaks in the joint between the rock and the bottom of the cofferdam are more difficult and are usually best stopped by dumping earth, clay, manure, etc., around the leak on the outside of the cofferdam.

UNWATERING

Unless the bottom of the cofferdam is between high and low water level on a tidal site where it can be drained through a gate or valve at low tide, or unless there is opportunity to waste the water at a low level nearby, pumping will, of course, be necessary.

For small cofferdams with good bottom, ordinary hand diaphragm pumps are suitable and convenient. If the volume of water is too great for hand work, portable diaphragm pumps driven by gasoline motors may be best. For very heavy or continuous pumping centrifugal pumps of 2-4-inch diameter are very effective and may be driven by gasoline, steam or electricity. Usually it is best for small jobs to use the pumps most easily available and when the duty is heavy several moderate-size pumps are better than one or two very large ones; they are cheaper, more easily transported and installed, can be set to better advantage, are more flexible, can be adapted without waste to varying amount of pumping, and give a reserve for breakdowns, repairs, etc.

If much excavation is to be done inside the cofferdam, the pump suctions should be put in one or more sumps. If any very leaky places are disclosed inside the cofferdam, they should be enclosed by separate interior cofferdams and be provided with independent pumps. If there are serious leaks through or inside of a large cofferdam, it should be sub-divided into smaller cofferdams in which the pumps can be successively concentrated and overcome the leaks singly or in small groups.

If the cofferdam is located above an adjacent waterfall or rapids, or near any lower ground where the water may be discharged, it may occasionally be possible to eliminate pumps and unwater by gravity. This may be done by carrying a discharge pipe through or below the bottom of the cofferdam and carrying its outlet to a place where the water can flow away freely. In this case care must be taken to puddle well around flanges where the pipe pierces the cofferdam or otherwise make a tight joint there.

If there is a deep ravine, low-level sewer or other disposal place available within reasonable distance, it may be possible to unwater the cofferdam through a siphon installed in the sump. This method obviates any trenching and will carry the water to a maximum height of more than 20 feet above the surface of the water in the cofferdam if the siphon pipe is air tight and properly filled. It should have valves at both ends and at the summit. After closing the end valves and opening the summit valve the pipe may be filled with water, then quickly and simultaneously reversing the valves will start siphonage, which will continue as long as the supply and discharge are unobstructed.

This method is not likely to be often available, but when it is, may prove economical for handling a large amount of water continuously.

Recent Legal Decisions

DEFECTIVE PERFORMANCE NO DEFENSE TO PAVING ASSESSMENT—PAVING STREET CAR TRACKS

In a suit by a municipality to foreclose a lien for street paving the general rule of law is held to be well settled that where the work is done the municipality, in the absence of fraud, must be the judge as to whether the contract has been complied with. In Church v. People, 174 Ill. 366, 51 N. E. 747, the court quoted with approval from Judge Cooley on Taxation to the effect that, in general, no defense to an assessment that the contract for work has not been performed according to its terms is allowed. But this doctrine must be confined within the proper limits. It cannot be extended to cover a case in which the authorities, after contracting for one thing, have seen fit to accept something different in its place, for, if this might be done, the statutory restraint upon the action of local authorities in these cases would be of no more force than they should see fit to allow. This the Mississippi Supreme Court considers the true line of demarcation. In such an action it holds, City of Jackson v. Buckley, 85 So. 122, that the contention that the original plans called for paving from curb to curb, whereas the city by proper ordinances changed the plans and eliminated a strip of neutral ground in the centre of the street occupied by a street railway company, presented no legal defense. The failure to pave the space between and near the street car tracks did not affect the city's right to require the abutting owner to pave one-third of the street directly in front of his property.

CONTRACT HELD TO CREATE PARTNERSHIP IN IMPROVEMENT CONSTRUCTION

A Missouri contracting company entered into a contract with a street improvement district in Little Rock, Arkansas, to construct an authorized street improvement. Two copartners doing business under a trade-name as a construction company in Arkansas entered into a contract with the contracting company providing that the construction company would finance the contracting company in the performance of the contract and assist it by furnishing bond to guarantee performance and to advance such sums of money necessary to pay all bills incurred during the progress of the work for labor and materials; and the contracting company agreed to indemnify the construction company against losses in the performance of the contract. The construction company, in consideration of its advances and assumption of obligations was to have all the net profits up to $3,000 and one-third thereof above $9,000. The contracting company proceeded with the construction of the improvement. In an action by a feed company for foodstuffs supplied to the contracting company, it is held, Hayes-Thomas Grain Co. v. A. F. Wilcox Contracting Co., Arkansas Supreme Court, 223 S. W. 357, that the contract between the contracting company and the construction company constituted a partnership. There was complete community of interest between them as to the subject-matter, which was the contract with the improvement district, and the profits to arise therefrom. The construction company, it was true, was to furnish certain equipment for use, but this was merely an incident to the main contract. There was no provision in the contract for the sharing of losses, but that was not necessary to constitute a partnership, for the law imposed such an obligation if a partnership existed. There was in the contract all the elements of a joint enterprise, and one of joint contribution to a common end, and the sharing of profits on specified terms, the elements which make a partnership in law. The copartners in the construction company were therefore held jointly liable as copartners with the contracting company. Conceding that the contract was ultra vires so far as the contracting company was concerned, because it was beyond its power as a corporation to enter into a partnership agreement, the company was held liable because the purchase of the feedstuff was in furtherance of the purposes for which the corporation was created, and the partners of the construction company as individuals could not take advantage of the fact that the contract was beyond the power of the corporation.

REGULARITY OF AWARD OF STREET IMPROVEMENT CONTRACT

A construction company applied for a mandate to compel a superintendent of streets to execute a contract presented to him in accordance with the statute for the improvement of certain streets, which he had refused to sign on the ground that the proceedings were void. The California Improvement Act of 1911, par. 61, as amended in 1915, requires the first specific mention of the amount of street improvement bonds to be included in the warrant. It is held, Federal Const. Co. v. Ryan, 191 Pac. 69, that a general reference to prior proceedings adopting the provisions of the act is sufficient to confer jurisdiction on the city council for the purpose of a resolution awarding a contract to the lowest bidder. The city council has jurisdiction to pass an amended resolution of an award of street work correcting a reference to bonds in the original resolution of intention to order the work. A city council's resolution and notice of award of street improvement work under the statute, reciting respectively that the contract was awarded to a company at prices named in its bid, and that the board of trustees awarded the contract to the lowest regular responsible bidder, the particular company, at the prices named for the work in its bid, were held to be in substantial compliance with the law. The mandate was directed to issue.

CONTRACT FOR CEMENT GOVERNED BY QUANITY REQUIRED

The Federal District Court for the Eastern District of Pennsylvania holds that a contract for the sale and purchase of cement to be used by the buyer exclusively in the construction of a government dry dock was one in which the quantity is determined by the requirements of the buyer, acting in good faith, in the construction of the dock; and in an action by the buyer for breach of contract by failure to deliver, it must allege and prove such requirements. Maryland Dredging & Contracting Co. v. Coplay Cement Mfg. Co., 265 Fed. 842. The court cited the case of Wolff v. Wells, Fargo & Co., 115 Fed. 32, 52 C. C. A. 626, where suit was brought for an alleged breach of contract for the sale of cement to be used in the construction of a certain building. The seller named a price "for what you may require, on about 5,000 barrels, more or less." It was held that the contract was not one to deliver any particular quantity, but to deliver so much as might be required in the construction of the building; the designation of "about 5,000 barrels, more or less," being merely the estimate of the parties as to the quantity which would be required.

CONSTRUCTION CONTRACTOR NOT LIABLE FOR INJURY BY REQUIRED FENCING

The Supreme Court of Colorado holds, McPhail v. Seerie Bros. Const. Co., 191 Pac. 103, that a contractor for the erection of a building who, in compliance with a city ordinance, erected a tight board fence on the streets where the building was under construction, was not liable for injuries to a bicycle rider who fell into an excavation made by a telegraph company located near a place where the street was partially obstructed by the fence; the construction company having a right to construct and maintain the fence.

RELEASE OF SURETY BY NEGLECTING TO RETAIN RESERVE UNDER CONTRACT

In an action on a road contractor's bond to recover the value of certain cement furnished by the county to the contractor, it appeared that the contract not only required the county to retain the reserved 25 per cent and the last payment until the contractor had paid all claims, but it further obligated the county to see that its cement bill was paid from month to month by deducting, if necessary, proper sums from the monthly or final payments. This the county neglected to do. It is held, Lewis County v. Aetna Accident & Liability Co., Washington Supreme Court, 191 Pac. 146, that the county could not recover from the surety for the amount due on the cement, since payment by a county to a contractor of the whole amount due, without deducting amounts due the county for material, which, under the contract, it had the right to do, was the giving up of a security for the debt on which the surety had the right to rely. A county cannot recover on a contractor's bond if it has itself breached the contract in any material respect.

INDEFINITE NOTICES OF INTENTION TO PAVE STREESS

The Oregon Supreme Court holds, Henderson v. City of Sheridan, 191 Pac. 350, that a notice of intention to improve a street in the city of Sheridan "by resurfacing from curb to curb, with a wearing surface of asphaltic pavement, and bringing said surface to the proper grade, crown, thickness and wearing surface," given pursuant to the city charter, was not sufficiently definite to give the city jurisdiction to make the improvement. The notice did not state how thick the wearing surface was to be, or what was to be the proper grade, thickness, crown and wearing surface, so that the abutting owners might estimate the expense they were likely to incur. No preliminary estimate and description is required by the charter, and no technical preliminary estimate is required in any event, but the court is of opinion that there should be something approaching reasonable certainty in the description of the main characteristics of the proposed improvement.

The same court, in Byers v. City of Sheridan, 191 Pac. 351, holds that a notice to improve a street in the city which simply described the improvement as a hard surface pavement 16 feet in width is insufficient to confer jurisdiction. The property owner was entitled to be informed in a general way whether it was in the contemplation of the city to pave with brick, stone, bitulithic, concrete, asphalt or any other material which might be employed under the notice.

RULE THAT VOLUNTARY PAYMENTS NOT RECOVERABLE DOES NOT APPLY TO A MUNICIPALITY

The county of Cayuga filed a claim in the New York Court of Claims against the state to recover money paid to the state as a part of the cost of construction of certain state highways for which, under the construction given by the Court of Appeals to the State Highway Law after the money was paid, the county was not liable, the state not being able lawfully to collect from any town in which the state highways were under construction any amount to meet such construction. In allowing the claim, the Court of Claims holds, Cayuga County v. State, 183 N. Y. Supp. 646, that jurisdiction of the claim was conferred on the court by Laws 1918, c. 657. The defense that the payment was a voluntary one does not apply to a municipality. While it is a well-settled principle of law that, where a voluntary payment is made because the error on the part of the person paying was one of law and not of fact, the person making such voluntary payment cannot recover, this rule has no application to a municipality or other public body. This rule of law is based upon the principle that such a payment is not voluntarily made by the municipality, but by its agent, in excess of his authority, and in defiance of its rights. It is not the act of the municipality itself, but of one who assumes to act for it without authority. This is the law not only in New York, but in many other jurisdictions.

NEWS OF THE SOCIETIES

Nov. 5-6—IOWA SECTION, AMERICAN WATERWORKS ASSOCIATION, Sixth Annual Convention, Iowa City, Iowa. Jack J. Hinman, Secretary-Treasurer State University of Iowa, Iowa City.

Nov. 8-12—LEAGUE OF CALIFORNIA MUNICIPALITIES. Annua lConvention, Chico, Calif. W. J. Locke, Pacific Bldg., San Francisco, Calif.

Nov. 10-12—NATIONAL DRAINAGE CONGRESS. Chicago, Atlanta, Ga.

November 12—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Second Fall meeting, Chicago. Sec., 33 W. 39th St., New York.

Nov. 12—CONFERENCE ON EMPLOYMENT AND EDUCATION, sponsored by the American Assn. of Engineers. Chicago.

Nov. 15-17—CITY MANAGERS, ASSOCIATION. Annual convention at Cincinnati, O. Executive Secretary, Harrison G. Otis, 812 Tribune Bldg., New York City.

Nov. 18-19—AMERICAN ENGINEERING COUNCIL. Organization meeting, Washington, D. C.

Dec. 7-10—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, New York. Secretary, 29 W. 39th St., New York City.

Dec. 9—THE BROOKLYN ENGINEERS' CLUB. Annual Meeting, election of officers.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

AMERICAN WATER WORKS ASSOCIATION
IOWA SECTION

At the sixth annual convention of this section which will be held in Iowa City, November 5-6, the following papers will be read: November 5th, "Tropical Water Supplies," by Don M. Griswold, State Epidemiologist, Associate Professor of Hygiene and Preventive Medicine, State University of Iowa; "Further Observations on the Eosine-Methylene-Blue Agar," by Max Lexine, Associate Professor of Bacteriology, Iowa State College, Ames, Ia.; "A Self-Cleansing Underground Water-Collecting System," by George T. Prince, consulting engineer, Omaha, Neb.; "Pumpers, or Triple Combination Chemical Engines," by William Molis, Superintendent of Water Works, Muscatine, Ia.; "Valuations of the Iowa City Water Company, Based on Present and Pre-War Costs," by John H. Dunlap, Professor of Hydraulic and Sanitary Engineering, State University of Iowa; "Popularizing Water," by Robert E. McDonnell, consulting engineer, Kansas City, Mo.; "Progress on the Dayton Flood Control Project," by Sherman M. Woodward, Professor and Head of the Department of Mechanics and Hydraulics, State University of Iowa. November 6th, "The Application of Copper Sulphate to Basin Walls for the Control of Algae," by George F. Gilkinson, chief chemist, Water Department, Kansas City, Mo.; "Value vs. Investment as a Basis for Utility Service Rates," by William G. Raymond, Dean, College of Applied Science, State University of Iowa; "State Provision for Water Supply Control," by Jack J. Hinman, Jr., Assistant Professor of Epidemiology and Water Bacteriologist, State University of Iowa, Water Bacteriologist and Chemist, Iowa State Board of Health.

The papers to be discussed at the "Round Table" are as follows: "Financing Water Main Extensions," "Cleaning Water Mains," "Fire Protection Charges," "Operating and Test Duty of Pumps," "Standardization of Meter Bolts," "Insurance of Pumping Machinery against Breakage," "The Use of Electric Weld Pipe."

INTERNATIONAL ASSOCIATION OF STREET CLEANING OFFICIALS

At the invitation of W. J. Galligan, assistant superintendent of streets of Chicago, 44 street cleaning officials, representing 28 municipalities of the United States and Canada, held a conference in that city on October 7th and 8th, the outcome of which was the forming of the International Association of Street Cleaning Officials. The object of the society is "the acquisition of knowledge relating to the cleaning of streets and the dissemination of this knowledge among the members of this Association with the view of improving the service and reducing the cost, and the establishment and maintenance of the spirit of fraternity among its members."

Members are of four classes—active, associate, honorary, and life. Active membership is limited to superintendents of street cleaning departments in municipalities and towns of the United States and Canada, and "other persons having charge of or connected with municipal street cleaning departments."

Associate members are "manufacturers of and dealers in appliances relating to the interests kindred to the Association."

The officers elected were: President, W. J. Galligan, assistant superintendent of streets, Chicago, Ill.; vice-president, Theodore Eichhorn, superintendent of streets, Erie, Pa.; secretary, A. M. Anderson, 1340 Old Colony Bldg., Chicago, Ill.; treasurer, Robert W. Waddell, city engineer, Kansas City, Mo.; and a board of governors. The constitution provides that the headquarters of the Association shall be determined by the residence of the secretary.

The subject of street flushing was discussed at length, the majority holding that this method was injurious to the pavements and the cause of many accidents. Colonel Sullivan of Boston spoke of the advantages of granite block pavement from a street cleaning viewpoint; littering of streets and discussion of wages were among the important subjects on the program. The consensus of opinion seemed to be that labor conditions are showing a tendency to improve. The matter of snow removal brought out interesting facts, the majority pronouncing the burning method a failure. Mr. Walsh of Minneapolis told of his success in using an ordinary combination road scarifier and grader, pulled by a tractor with caterpillar traction. The scarifier breaks the ice and the road machine blade moves the snow and ice to the gutters or catch basins. Much damage is caused by allowing the snow to remain too long on asphalt streets.

AMERICAN SOCIETY of MECHANICAL ENGINEERS

The society announces the following officers elected: Edwin S. Carman, president; John L. Harrington, Leon P. Alford, Robert B. Wolf, vice-presidents for two years; Henry M. Norris, Carl C. Thomas, Louis C. Nordmeyer, managers for three years; Major William H. Wiley was reelected treasurer. The secretary will be elected by the society's council at the annual convention which will be held in December in New York City.

The council has announced extensive plans for promoting professional endeavor and public service, particularly as to industrial relations and rewarding engineering achievement. The finance committee recommended a budget of over $500,000 for the ensuing year. The engineering foundation fund for the promotion of engineering research, of which the society is one of the sponsors, will very soon amount to $1,000,000.

John H. Barr of New York, formery professor of machine design at Cornell, has been appointed the society's representative on the National research Council for a term of three years.

The special committee appointed to interpret a declaration contained in a resolution adopted at a general session held December 3, 1919, says: "The central thought in this declaration is that production is the utilization of the forces of productivity, that product comes into being through the action of those forces, that the purpose of industry is to produce goods for the use of mankind and, therefore, it must be conducted from the motive and in the spirit of rendering essential service to society as a whole, which, of course, includes the workers themselves. The committee is at work upon an interpretation of the declaration in regard to credit capital, and intends to present this in the form of a supplementary report."

The meetings and progress committee have detailed plans for the annual convention of the society in New York in December and also announced plans for a congress of mechanical engineers to be held in Chicago next spring.

The society has formed an aeronautic section, the membership including Orville Wright, Howard E. Coffin, Edward A. Deeds, Jesse G. Vincent and Elmer A. Sperry.

THE BROOKLYN ENGINEERS' CLUB

Announcement is made of the following meetings: November 4, "The German Long-Range Gun," by Lt.-Col. H. W. Miller; November 11, "City Planning for the Borough of Queens," by Charles Powell; November 18, "Industrial Brooklyn, Paper No. 2," by Walter Pfaendler; December 2, informal talk by E. C. Wilder.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

CONCRETE CONSTRUCTION DEVICES

The Concrete Devices Corporation has issued a circular descriptive of time and labor-saving devices for plain and reinforced concrete construction covering thirty United States patents pending or devices mentioned that have been invented by George F. Newton. These include form clamps, form clamp keys, washers, form ties, form spreaders, bar spacers, bar hangers, corner bar clips, beam saddles, floor chairs and concrete inserts.

The hook spreader system is used mainly for ship construction and for walls under 6 inches thick. Like most of the other devices, it is formed mainly of heavy hard drawn steel wire provided with suitable bearings and adjustments. This device consists essentially of a double hook permanently embedded in the wall that engages the reinforcement bars and is attached to adjustment hooks passing through the forms and provided with exterior wedge bearings.

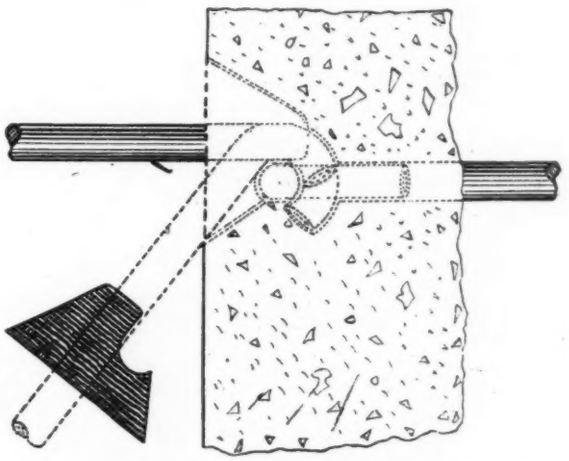
The plain spreader for thicker walls is provided with separate clamps to the reinforcement rod and is adjusted by wedges at both ends which engage a special cast-iron bearing washer which is nailed to the form. One hammer blow on the clamp key tightens and holds the form and steel reinforcement securely. The system costs less than other methods, saves a large amount of time in assembling the reinforcement, avoids cutting steel after forms are removed and eliminates tightening wrenches, set screws, and rod pullers.

A very important advantage of this spreader is that after the forms are stripped, releasing the exterior form tie and washer the former can easily be slightly moved by hand, destroying adhesion of the concrete to the washer and enabling the latter to be slid out on the tie, clear of the surface of the concrete, and the tie to be unhooked from the permanently enclosed inside spreader.

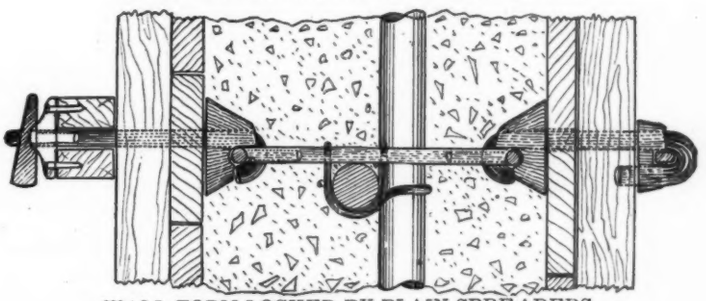
This leaves a small conical hole in the face of the concrete into which the eye of the permanent spreader projects sufficiently to provide efficient anchorage for the mortar with which the hole is subsequently pointed.

One of the most distinctive of the appliances is the bar clip, made of spring wire, and snapped instantly into position at the intersection of two bars of any size or shape, holding them securely in position and not requiring the use of any tools or adjustment.

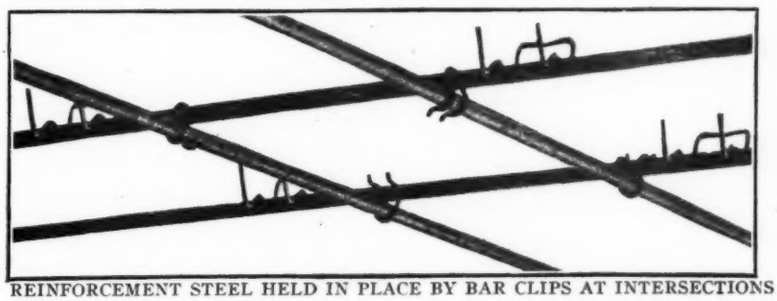
Form clamps and form ties are bent rods with end hooks engaging adjustment wedges by which they are quickly tightened. The form washers are small castings designed to draw the loop of the form spreader up to the shoulder of the washer and in one operation to prevent sagging or spreading of the form.



REMOVING EXTERIOR TIE AND WASHER



WALL FORM LOCKED BY PLAIN SPREADERS



REINFORCEMENT STEEL HELD IN PLACE BY BAR CLIPS AT INTERSECTIONS

Bar spacers are wires with U-shaped bends in them, that are snapped over reinforcement rods to hold the latter securely in any required position.

Bar yokes for splicing bars are U-shaped plates perforated to receive a tightening wedge. The plate engages the overlap of the bars and holds them firmly in position by driving the wedge. By its use the overlap of bars may be reduced from 40 to 10 diameters. The bottom of the wedge is concaved to provide two knife edges that cut into the bars, thus holding them still more securely.

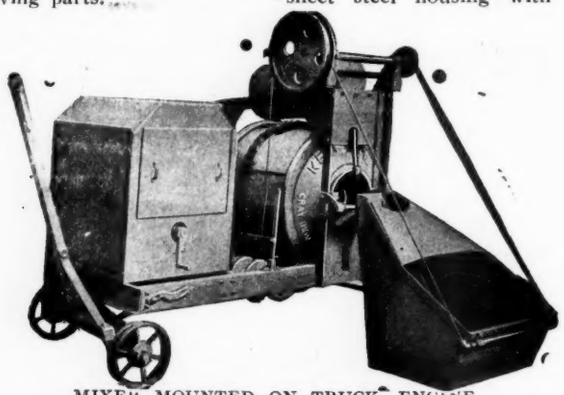
Floor chairs for round or square bars, provide a rigid connection for intersecting bars that may be simply snapped into place without the use of tools, and permanently supports them at the required distance above the bottom of the form, thus eliminating wood or cement blocks. They displace a minimum amount of concrete.

TRUCK SALES INCREASE

Sales of Mack trucks for September represented a 9 per cent increase over August. Comparing this year with last, the company states that September, 1920, showed a 44 per cent increase over September, 1919. Taking the three months' period ending September 30th as a basis, the sales of Mack trucks of capacities from 5 to 7½ tons, increased 55 per cent this year over last year. This indication of the economies offered to shippers by big-unit hauling bears out the general belief that transportation costs can be reduced by encouraging the use of the large capacity truck.

KEYSTONE MIXER

The Keystone mixer, model 10, power loader, manufactured by the Gray Iron Foundry Company, is recommended by them for its excess strength, power and thoroughness of mixing. The over-all dimensions and weight are less than those of any other power loader of full batch capacity on account of its simple construction and few moving parts.



MIXER MOUNTED ON TRUCK, ENGINE ENCLOSED IN STEEL HOUSING

In each pocket mixing wings are arranged to churn and rechurn the mix thoroughly in 1 minute. Free operation of this drum with minimum friction is secured by drum roller bearings of extra length that require oiling only once in two weeks. The extra large dimensions of the charging bucket eliminate trouble and delay in loading; the discharge is governed by a hand wheel and is very rapid and complete. The mixer is provided with a positive gravity water measuring tank that promotes uniformity and improves the quality of the concrete. The bucket is hoisted by an endless cable, the hoist being of the expanding ring type designed for hard service, readily adjustable and operated by a single lever which controls both hoist and brake.

The machine is provided with a sheet steel housing with removable rear and side doors which is complete, compact and easily portable. The drum capacity is 10 cubic feet of loose materials, or 6 2-3 cubic feet of mixed concrete per batch. The machine is driven by a 6-h. p. vertical gasoline engine with a speed of 475 revolutions and a drum speed of 21 revolutions per minute. The weight, complete, is 3,600 pounds.

PERSONALS

Whitecarver, O. W., has been appointed assistant U. S. district engineer at Charleston, S. C.

Painter, Capt. P. C., has been appointed city engineer of Washington, N. C., and will take charge of important paving, sewerage and waterworks construction next spring.

Stewart, Major J. W., Corps of Engineers, U. S. A., has been retired for physical disability.

Cooley, Mortimer E., dean of the College of Engineering and Architecture, University of Michigan, has been made a member of the Postal Advisory Committee.

Walker, L. C., has been appointed to the U. S. Reclamation Service and assigned to survey for the American Falls Reservoir, Idaho.

Edwards, J. T., has been appointed supervisor of maintenance in the road department of the New Jersey State Highway Commission.

Anderson, W. H., has been appointed drainage engineer for the St. Louis Southwestern Railway, with headquarters at Dallas.

Snead, C. D., has been appointed bridge engineer of the U. S. Bureau of Public Roads at Montgomery, Ala.

Copp, W. P., has been appointed professor of civil engineering at Dalhousie University, Halifax, N. S.

Dunlap, F. C., has been appointed chief of the Bureau of Street Cleaning, Philadelphia.

McDermott, J. R., has been made assistant division engineer of the West Virginia State Roads Commission.

Bringhurst, J. H., has been appointed assistant engineer in the Bureau of Highways, Philadelphia.

Easler, R. P., has been made manager of the West Coast Dredging Co.

Dyatt, A. E., has been made resident engineer on Federal aid work in Douglas county, Kansas.

Harwood, R. E., civil engineer and road contractor, died recently in Springfield, Ohio.

Meredith, John W., has been appointed city engineer of Antioch, Cal.

Bonar, S. H., has been appointed city engineer of Moundsville, W. Va.

Ridley, C. E., has resigned as city engineer of Port Arthur, Texas.

Willey, N. F., contractor and builder, died at Norwich, N. Y., August 28.

Sheldon, Prof. Samuel, Polytechnic Institute, Brooklyn, died September 5.

Hilgeman, Henry, contractor and builder, of Ft. Wayne, Ind., died recently.

Moyes, W. E., general contractor, died June 21, at Sharpburg, Pa.

Gates, R. M., has been appointed managing engineer of the Philadelphia district of the Lakewood Engineering Co.

Waterhouse, Dr. G. B., has been appointed inspecting and metallurgical engineer of the Lackawanna Steel Co., Buffalo.

Albright, John, has been appointed erecting engineer for the Champion Engineering Co., Kenton, Ohio.

Parin & Marshall have moved their consulting engineer office to 1107 Broadway, New York City.

The J. C. Mack Co., general contractors, have moved their offices to 103 Park avenue, New York City.

The Phrale Construction Co. has been formed and opened offices at 316 Marine Bank Building, Erie, Pa.

McGuire, B. F., general contractor, has opened an office at 500 Fifth avenue, New York City.

H. R. Douglas & Son, general contractors, have opened an office in the Barrows Building, New London, Conn.

Wilmot, E. A., civil engineer, recently died at Victoria, B. C.

Hill, William, contractor, Chatham, Ont., died September 6.

Begg, J. M., has been appointed engineer of waterworks improvement at Brandon, Manitoba.

Shupe, Stanley, has been appointed acting town engineer of Oshawa, Ontario.

The Willite Road Construction Company of New York, Inc., has just started construction of 50,000 square yards of the Hudson County boulevard, Jersey City, which is the Atlantic Tidewater terminal of the Lincoln Highway.

Darcy, H. J., has been appointed state sanitary engineer of Oklahoma.

Hoover, C. B., has been appointed engineer of water works extensions, Columbus, Ohio.

Gray, C., has been appointed chief engineer, Indiana Highway Department.

Wright, L. H., chief engineer of Indiana State Highway Department, has resigned that position.

Connery, Major F. C., civil engineer for the Pearson Engineering Corporation, of New York City, who served with the Canadian Forces in France, died in Toronto, September 18.

Wigmore, R. W., formerly commissioner of water and sewerage for the city of St. John, New Brunswick, has been re-elected to the House of Commons.

Andrews, M. O., general manager of the Unit Construction Company, Fall River, Mass., died August 9.

Rogers, C. G., contractor and builder, Potsdam, N. Y., died August 23.

Parker, J. L., has been appointed senior highway bridge engineer for the South Carolina State Highway Commission.

Davies, J. C., has been appointed testing engineer for the State Highway Department, Oklahoma.

Bruce, J. A., city engineer of Omaha, has resigned to enter the engineering firm of Bruce & Grupe, Omaha.

Miller, W. E., has opened engineering office for steam and electric railway and public utilities work at Madison, Wis.

O'Brien, E. J., & Bro., Inc., engineers and contractors, have opened an office at 299 Division avenue, Brooklyn, N. Y.

Frost, Ford & Westell Construction Co., general contractors, have opened general contracting offices at 400 Penobscot Building, Detroit.

Dwight P. Robinson & Co., Inc., have opened a new branch office in Youngstown, Ohio, and have moved their Cleveland office to the Citizens' Building.